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## EARLY LESIONS AND THE DEVELOPMENT AND INCIDENCE OF LEPROSY IN THE CHILDREN OF LEPEERS

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SIX PLATES

Since 1906 the lepers in the Philippine Islands have been segregated on Culion Island with the view to reducing and finally exterminating leprosy. Thus, a colony for lepers has been established which at present contains a population of about five thousand.

At the beginning of the establishment of the colony children conceived outside were born there; since then, on account of inter-marriage among lepers, the number of births in the leper colony has been steadily increasing. In 1916 a limited number of healthy children were isolated in a separate building known as the "Negative Children's House," located away from the leper population. Also, a small number were sent away from Culion Island and adopted by relatives or other persons who guaranteed their ability to take care of them. However, on account of the inadequate facilities for isolation, the immense majority of the children born of leper parents were permitted to live with them and among other lepers.

There were born in the colony, since 1906 to December 31, 1921, inclusive, 689 children. Of this number 333 died and 51

were sent away from Culion, 3 of whom were returned later to the colony. There were residing at the end of 1921, 308 children born in the colony (both parents of practically all of them being lepers) the majority of whom were living among lepers; a limited number were isolated in the Negative Children's House after having been in intimate contact with lepers for varying lengths of time.

The children now living in the Culion Leper Colony, born of leper parents and raised among lepers—that is, in an ideal environment for infection—offer favorable material for the study of the early lesions and the development of leprosy. This paper is the result of the study of the records in the colony, and repeated clinical and bacteriological examinations made during the period between June, 1921, and March, 1922, of all children born up to December 31, 1921, inclusive, and now residing in the colony.

#### MORBIDITY AND MORTALITY

As a rule the healthy children of lepers show the same physical and mental development as do the children of healthy parents.

No records were kept in the colony of minor ailments among the children, but the general observation is that they are subject to the diseases of childhood that occur among children of the same age in healthy communities; and that they are not particularly susceptible to any childhood disease.

On examination of the children we were struck by the frequency of diseases of the skin other than leprosy. Over one-third of the number examined showed active or recent lesions of an itch of some kind, which in many cases persists for years and becomes generalized all over the body and is eczematous in nature. There are also a few others suffering from tinea, yaws, and other skin diseases.

No comparison can be made with the incidence and nature of skin diseases in nonleper communities, as no data are available; but it seems that the "itch" among the children of lepers is rather rebellious to treatment.

The mortality among children of lepers during the first years of the establishment of the colony was very high; none of the children born in 1906 and 1907 survived. The mortality steadily decreased in subsequent years on account of better care and accommodation of the population. In the City of Manila from 1905 to 1918, inclusive, deaths among children under 1 year of age averaged 41.3 per cent of the total number of births (stillbirths excluded).<sup>(6)</sup> In the Culion Leper Colony, up to De-



cember 31, 1921, there were 290 deaths, or 42 per cent, among children under 1 year of age out of a total of 689 births, excluding stillbirths. This is practically the same percentage of infantile deaths as occurs in a nonleper population.

Table 1 gives an idea of the ages and the causes of death of children of lepers born in the colony. These data have been gathered from the colony records; the diagnoses cannot be considered as very accurate, as no autopsies of such children were made.

TABLE 1.—*Causes of death among children born of leper parents in the colony, by age groups and by causes of death, from May, 1906, to December 31, 1921, inclusive.*

Cause of death.	Age groups, years.			Total.
	0-1	1-2	2 +	
Asphyxia neonatorum.....	1			1
Beriberi.....	16	2		18
Bronchitis, acute.....	14	1		15
Bronchopneumonia.....	10	1		11
Congenital debility (including athrepsia, malnutrition, and marasmus).....	95	4	1	100
Diarrhoea and enteritis.....	3			3
Diphtheria.....			1	1
Dysentery, bacillary.....	10	6	2	18
Gastritis.....	10			10
Gastroenteritis, acute.....	31	4	1	36
Gastroenteritis, chronic.....	6	3		9
Infantile convulsions.....	49			49
Influenza.....	3	4		7
Ill defined.....	24			24
Malaria.....	1	2	2	5
Meningitis.....	4	1	2	7
Nephritis.....	5	2	2	9
Pneumonia.....	3			3
Prematurity.....	3			3
Umbilical tetanus.....	2			2
Tonsillitis.....		1		1
Varioloid.....			1	1
Total.....	290	31	12	333

On examining Table 1 it will be noticed that infantile debility (including malnutrition, athrepsia, and marasmus) holds the first place among the causes of death; then follow the gastrointestinal disturbances and infantile convulsions. According to the annual reports of the Director of Health of the Philippine Islands, during the period from 1904 to 1920, there were, in the City of Manila, 8,451 deaths, or 14.6 per cent, from congenital debility out of a total of 57,782 deaths from all diseases of

children under 1 year of age. According to Table 1 there were 100 deaths, or 34 per cent, due to infantile debility out of a total of 290 deaths from all causes in children under 1 year of age. Therefore, the proportion of deaths from infantile debility is relatively higher than in nonleper communities, which may be presumed to be due to the weakened condition of the parents.

The increase in deaths from infantile debility is partly compensated by the small number of deaths from infantile beriberi, which is one of the important causes of infant mortality in nonleper populations. This is due to the use of unpolished rice in the diet in the colony.

#### THE SITE OF THE EARLY LESION

Our data regarding the site of the initial lesion of leprosy are based on comparison of the physical and bacteriological examinations of the skin and nose. Bacteriological examination was made of the skin of all children showing suspicious or characteristic lesions, and in practically all of these the secretion and scrapings from the nose have also been examined. Dr. Felisa Nicolas, of the eye, ear, nose, and throat department of the Philippine General Hospital, on a visit to Culion, kindly made inspection of the noses of twenty-six children who either were nonlepers or showed suspicious or definite lesions of leprosy in the skin. The findings of Doctor Nicolas, compared with results of the physical and bacteriological examinations of the skin lesions and the nose, are shown in Table 2.

The physical examination of the skin comprised, besides inspection, the testing for tactile and thermal anæsthesia and the determination of areas of anhidrosis by the injection of pilocarpine solution. Tactile anæsthesia was tested by the light application of the point of a pin and asking the child to point out the location where the pin was applied. Thermal anæsthesia was tested by applying alternately hot water and cold water in test tubes; this test was applied to older children who could give intelligent answers. To test the anhidrosis a solution of 1 milligram of pilocarpine nitrate to 1 cubic centimeter of water was prepared, and subcutaneous injection was made of an amount that was proportionate to the age of the child as figured by the formula of Young,<sup>1</sup> on the basis of 5 milligrams as the average dose for the adult; and, in addition to the pilocarpine, hot tea was given to drink, and the child wrapped in a

<sup>1</sup>  $\frac{12 + \text{age}}{\text{age}}$  = the denominator of a fraction the numerator of which is 1.



blanket and examined after the breaking out of copious sweat. The sensibility to pain was not tested because, except in extreme cases, it is hard to determine from the answers of the children the dissociation of the tactile and the pain sensations.

The physical examination of the nose was made with the aid of a nasal speculum, in ordinary daylight, which naturally did not show the hind portions of the nasal cavity.

The specimen for bacteriological examination was obtained by scraping about the edge of the suspicious lesion in the skin; or, in the case of the nose, by scraping the suspicious lesion noticed on the physical inspection; or, in the absence of such lesion, the specimen was obtained from the site at about the junction of the cartilaginous and bony portions of the septum. The scraping was made with a sharp knife until a small amount of serum and blood was obtained; this material was smeared over a glass slide, fixed by heat, stained by steaming carbol-fuchsin, washed in water, and decolorized with Gabbett's methylene blue.

TABLE 2.—Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
		<i>Yrs.</i>					
1	F.T.	10	Negative	—	Negative	—	Nonleper.
2	S.P.	7	Negative; no scabies.	—	Erosion of mucosa, anterior portion septum, both sides.	—	Do.
3	B.M.	6	Negative	—	Right side negative; small ulcer septum, left side, anterior margin of quadrilateral cartilage.	—	Do.
4	A.C.	2	do	—	Slight erosion, mucosa, both sides of septum.	—	Do.
5	A.N.	8	White area on right side; scabies; no pilocarpine test made.	—	Shallow ulcer, right side, anterior portion of septum; left side negative.	—	Suspicious.
6	L. de la C.	8	White particles on face and neck and chin, which are not anæsthetic and show sweating on pilocarpine injection.	—	Left side apparently negative; small nodule right side septum, anterior margin quadrilateral cartilage.	—	Do.

TABLE 2.—Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921—Continued.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
7	V. C.	8 Yrs.	White area on right loin; no anæsthesia and no anhidrosis.	—	Negative, both sides.	—	Suspicious.
8	A. V. S.	8	White spot over right loin showing center, which does not sweat on pilocarpine test.	—	do	—	Macular.
9	A. F.	7	Whitish, nonanæsthetic areas which do not sweat on face, left buttock, and right thigh.	—	Left side negative; ulcer right side of septum, anterior portion.	—	Do.
10	L. T.	8	Whitish, anhidrotic area on left loin; apparently flushed face like sunburn, but no anæsthesia.	—	Ulcer both sides of septum, anterior portion.	—	Do.
11	M. de L.	6	White area above right knee; primary yaws; pilocarpine test unsatisfactory.	—	Negative	—	Do.
12	G. D.	5	White anhidrotic spots all over the body, which show no tactile anæsthesia.	—	Negative, both sides	—	Do.
13	F. A.	2	Small whitish areas all over body with reddish centers, especially on limbs; no anæsthesia and no anhidrosis.	—	do	—	Do.
14	M. Z.	12	Whitish, anæsthetic, anhidrotic area on back of left thigh.	—	do	—	Maculo-anæsthetic.
15	M. C.	8	Diffuse reddish area from nates to foot of left leg, both legs flushed; white anæsthetic areas on inner side of right thigh.	—	do	—	Do.



TABLE 2.—Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921—Continued.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
16	P. I.---	Yrs. 7	White anæsthetic spot on left cheek and anæsthesia on right ulnar region; pilocarpine test unsatisfactory.	—	Right side negative; small depression anterior portion septum, left side.	—	Maculo-anæsthetic.
17	G. M.---	6	White anæsthetic area on back of left side and another similar area about 2.5 centimeters in diameter on right thigh; no sweating in white area.	—	Ulcer anterior portion septum, right side; with atrophic changes of the mucosa of the turbinate on both sides.	—	Do.
18	A. T.---	11	Advanced nodular case.	+	Left side infiltration of middle septum and corresponding portion of middle turbinate producing adhesion between the two surfaces; erosion at nasal orifices.	+	Nodular.
19	R. N.---	10	Reddish, slightly infiltrated right ear; anæsthesia on left ulnar region; skin on left arm and elbow thickened and reddish; diffuse reddish area on right forearm.	+	Left side negative; small ulcer right side septum, anterior portion.	—	Maculo-nodular.
20	J. R.---	10	Marked nodular case.	+	Ulceration and infiltration of right inferior turbinate; two small nodules anterior portion of septum, left side.	+	Nodular.
21	E. S.---	10	Maculo-anæsthetic spot on back which does not sweat.	+	Left negative; small ulcer right side septum, anterior portion.	+	Maculo-anæsthetic.
22	J. C.---	9	Well-developed nodular case.	+	Small infiltrated area right side of septum, anterior portion; left side negative.	+	Nodular.

TABLE 2.—Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921—Continued.

No.	Ini- tials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacte- riologi- cal.	Physical.	Bacte- riologi- cal.	
23	A. C.	8 <i>Yrs.</i>	Rounded white patches with red centers on face.	+	Inner aspect right ala nasi with ulcer; superficial ulcer anterior portion septum, left side; corresponding portion of right side slightly swollen and with scab.	+	Macular.
24	B. R.	7	White anæsthetic patches all over the body; many of the spots show reddish centers. Some of the spots show sweating and others do not.	+	Small nodule anterior portion septum, right side; thickened right ala.	+	Maculo-anæsthetic.
25	F. R.	5	White anæsthetic and anhidrotic spot on back.	+	Nothing abnormal on right side; vestibule left side with scales.	—	Do.
26	P. B.	5	Some doubtful spots and a slight infiltration of right cheek; unsatisfactory pilocarpine test.	+	Negative	—	Infiltration.

On examining Table 2 one notices that there exist bacteriologically negative erosions and ulcers in nonleprous children; that some children, showing suspicious, bacteriologically negative lesions in the skin, show erosions, ulcerations, or nodules which are invariably bacteriologically negative; that children who show skin lesions which are bacteriologically positive are not necessarily bacteriologically positive in the nose and that the nose in these cases may either show ulcerations (No. 5, A.N.) or not (No. 25, F.R., and No. 26, P.B.); that in cases in which the bacteriological findings of the nose were positive there were definite lesions in the septum; and that, invariably, bacteriologically positive lesions were found in the skin in cases which are positive bacteriologically in the nose.

Table 3, which summarizes the types of lesions and bacteriological findings in the skin and nose of the twenty-four children



born in the colony who at the present writing are unquestionably lepers, confirms the findings in the preceding table, in that in all of the twenty-four cases lesions of the skin were found positive while only thirteen were bacteriologically positive in scrapings from the septum of the nose; the other eleven were bacteriologically negative in this site.

Our records show two children (No. 13, A.C. and No. 12, A.M., Table 3) who, on former bacteriological examinations, were positive only in skin lesions, and now they are positive bacteriologically in the skin and nose. Two other children (G.D. and P.I.), showing suspicious lesions in the skin, were repeatedly examined bacteriologically with negative results and, after an interval of six months, became positive bacteriologically, only in the skin so far.

Bacteriological but not physical examination was made of the noses of sixty-one other children, from 1 to 12 years old, with negative results. Their skin was also negative bacteriologically and showed lesions; such as flushed skin of the legs only, suspicious or characteristic white patches in some of which there was a definite reddish tint indicating progressive changes, or definite anæsthesia either in white patches or in regions of the body which show no skin blemishes.

Considering the above data, one might conclude that the early lesion is located in the skin and not in the nose. Our results are at variance with the theory of Sticker,<sup>(7)</sup> who claimed that the nose was the site of the initial lesion of leprosy, and are in conformity with the results obtained by Brinckerhoff and Moore,<sup>(1)</sup> who concluded that the routine examination of the nasal septum and the nasal secretions is not an efficient method for the detection of leprosy in its incipient stage.

#### THE NATURE OF THE EARLY LESION

It is natural that in young children it is hard to obtain reliable history as to subjective sensations, and the main reliance on manifestations of the disease must be looked for in the subjective signs in the skin. We have found that the commonest manifestation of the disease is the appearance of macular lesions, which are whitish patches resembling morphea spots and which we refer to here as "macula alba."

The macula alba are whitish light fawn in color, level with the skin, and have a smooth, nonscaly surface and irregular edges of from 1 to 10 centimeters wide. They appear singly and gradually increase in size and number, or they may break out in

crops. The commonest locations are the trunk, buttocks, thighs, arms, and face. They simulate tinea of the skin, commonly called "pañó blanco," a common affection among Filipinos, but from which they can be easily distinguished on account of the rounded shape, small size, and elevated furfuraceous surface of the tinea lesions when these are early and discrete; also, scrapings from tinea lesions treated with 10 per cent caustic potash solution show fungi, whereas no fungi are found in the white patches of leprosy. They are differentiated from vitiligo or leucoderma because in these there is often an increase of pigmentation on the border of the patches producing a sharp contrast between the lesion and the surrounding skin, which is not noticed in leprosy.

In the early macula alba there is no loss of hair, no change in the activities of the sudoriferous glands as tested by the injection of pilocarpine, and no change in the sensibility to touch or to heat or cold. The majority of the macula alba are bacteriologically negative, but in older patches, especially those showing a reddish tint, *Bacillus lepræ* may be found.

In some of the white patches that did not show tactile anæsthesia there was noticed an inability to distinguish thermal differences, and in patches where both tactile and thermal anæsthesia existed the thermal was found to be more extensive.

The test for tactile discrimination—that is, ability to distinguish whether the affected region is touched by one or by two points—was not systematically applied, on account of the unreliability of the answers of children.

Injections with pilocarpine nitrate and administration of hot tea in an effort to determine the absence of sweat in certain portions of the body, especially in connection with blemishes and white areas of the skin, were not always satisfactory; as the child, being covered, had the tendency to move and wipe away the moisture. It was noticed in connection with the white areas that in some cases, after injection, the white area was absolutely smooth and dry, whereas the skin in the immediate vicinity was moist; in other cases the white areas were dry, but the immediately surrounding skin was also dry and the corresponding area of the skin on the other side of the body was also dry. In other cases the white areas showed definite sweating similar to the surrounding skin.

Another early objective sign also seen in the leprosy of children is the shiny and flushed appearance of the legs occurring coincident with, or independent of, the white patches. Also, in-



filtration of the ears or of parts that are frequently subject to friction and traumatism, such as the elbows and knees, may be the first manifestation of the disease.

In some of the older children we were able to elicit a history of paresthesia, hypesthesia, and anæsthesia as the first and, frequently, only manifestation of leprosy. Such disturbances were frequently noticed first on the peroneal side of the leg and the ulnar side of the forearm or on the external maleolus and the back of the elbow joint; and, occasionally, on close examination one can notice also isolated patches of anæsthesia in other parts of the body.

We were not able to see or obtain a clear history of bullæ formation, which is one of the first manifestations of leprosy, pointed out by Dyer<sup>(3)</sup> and by Gwyther.<sup>(4)</sup>

Hopkins<sup>(5)</sup> has already noted that the macular lesion is the most constant of the early manifestations in all types of skin leprosy and that such a macule is usually unaccompanied by symptoms, such as pain or itching, that would likely attract the attention of the patient. We cannot state that all the white patches that we noticed in children are leprosy, in the absence of other functional nervous disturbances and other definite leprosy lesions. It is significant, however, that such blemishes are so prevalent among the children of lepers, about one-fourth of whom, as noted in Table 5, show this type of lesion with or without concomitant functional nervous changes. On the other hand, we have seen definite evidences of progressive changes in these whitish patches; that is, in the course of time they became reddish, infiltrated, and bacteriologically positive, as shown in Plate 5, figs. 1, 2, and 3. We have also found some white patches (Plate 2, figs. 2 and 3), which were bacteriologically positive, and which on their physical appearance could not be distinguished from bacteriologically negative patches (Plate 1, figs. 1, 2, and 3; and Plate 2, fig. 1).

#### DEVELOPMENT OF THE DISEASE

After the first lesions, such as white areas, anæsthesia, flushed legs, and infiltrations, the disease progresses by the aggravation of the preceding conditions. The white areas increase in number, may remain white or may acquire reddish edges (Plate 4, fig. 1; and Plate 5, fig. 3) or centers (Plate 5, figs. 1 and 2), may become more or less elevated, and previously bacteriologically negative patches may become positive. The infiltrations become more accentuated, and nodules appear on the ear, the

face, and other parts of the body. The skin of the legs becomes dry and scaly, suggesting ichthyosis. Single ulcers break out on the legs and the feet, which are chronic and difficult to heal. Anæsthesia may be noticed in connection with other lesions, but occasionally this is about the only definite sign of leprosy present, the patient being bacteriologically negative and showing neither thickening of the superficial nerves nor other physical appearance indicative of trophic disturbances.

The development of leprosy is suggested by the type of lesions that appear in children, according to their age, as shown in Table 3.

TABLE 3.—Positive lepers, arranged in order of age.

No.	Initials.	Year of birth.	Age.	Sex.	Lesions arranged according to order of appearance.	Bacteriology.	
						Skin.	Nose.
			Yrs.				
1	C. B.	1918	3	M	Macules white and one red macule	+	—
2	A. de L.	1917	4	F	One white macule	+	+
3	R. R.	1917	4	F	Macules white	+	—
4	M. G.	1917	4	M	Macules white and red	+	—
5	F. R.	1916	5	M	Macules white	+	—
6	G. D.	1916	5	F	Macules white and red; nodules	+	—
7	T. R.	1915	6	M	Macules white	+	—
8	I. P.	1915	6	F	do.	+	—
9	B. R.	1914	7	M	Macules white and red; infiltration; anæsthesia.	+	+
10	P. I.	1914	7	F	Macules white and red	+	—
11	F. B.	1914	7	M	Macules white	+	—
12	A. M.	1913	8	F	Macules white; anæsthesia	+	+
13	A. C.	1913	8	F	Macules white and red	+	+
14	F. Z.	1912	9	M	Nodules	+	+
15	G. M.	1912	9	M	Macules white; infiltration	+	+
16	J. C.	1912	9	F	Nodules; macules white and red; anæsthesia	+	+
17	A. C.	1912	9	M	Anæsthesia; nodules	+	+
18	E. S.	1911	10	M	Macules white	+	+
19	J. R.	1911	10	M	Anæsthesia; nodules	+	+
20	R. N.	1911	10	F	Infiltration; anæsthesia	+	—
21	A. T.	1910	11	F	Macules white; nodules; anæsthesia	+	+
22	D. S.	1909	12	F	Macules white; anæsthesia	+	—
23	E. R.	1909	12	F	Macules white; nodules; anæsthesia	+	+
24	F. S.	1908	13	M	Anæsthesia; nodules; macules white	+	+

Table 3 has been arranged according to the correlative age of the children, and the types of lesions are listed in the order of their appearance as far as could be ascertained. It shows that the majority of the younger children, while bacteriologically positive in the skin, are negative in the nose; also that, as a general rule, the younger children show only macular lesions and, as the children grow older, infiltrations, anæsthesia, and



nodules appear; and that, with the exception of two cases (F.S. and J.C.), when macular lesions (usually whitish) coexist with other lesions, the former appear first; in four cases there were no macular patches and in two of these (J.R. and A.C.) anæsthesia preceded the nodules, in one there were infiltration and anæsthesia, and in another only nodules.

The early lesion and the development of leprosy are also illustrated by the following records of children who are bacteriologically positive lepers:

I.—C.B. (Table 3, No. 1), Filipino, 3 years old, male. Born in Culion. Father nonleper, living outside. The mother and maternal grandfather are lepers living in Culion. One sister 15 years old, one brother 13 years old, and one sister 8 years old are nonlepers living outside.

He has been living since birth within the leper population. In June, 1921, this child was negative physically and bacteriologically. In February, 1922, he showed several white areas on the left cheek, right loin, right buttock, external surface of right thigh, posterior surface of left thigh, posterior surface of right arm, ulnar side of right forearm, and back of left arm, and two slightly elevated areas on the surface of the left thigh. There was one white area on the anterior surface of the left forearm which showed an elevated, infiltrated, distinctly red center (Plate 5, fig. 1). The skin of both legs was flushed. There was no anæsthesia. There were some scars due to scabies. The nose was negative on physical examination.

According to the mother the first spot that appeared was the one on the left cheek, about eight months ago; three months later the area on the right buttock and the rest of the patches appeared in rapid succession, practically at the same time. The reddening and infiltration of the center of the white patch on the left forearm was noticed only about one month ago.

The bacteriological examination in February, 1922, showed bacilli in the white patches, but much more numerous in the red center of the area of the left forearm. The nasal septum was bacteriologically negative.

II.—G.D. (Table 3, No. 6), Filipino, 5 years old, female, born in Culion in 1916. Both parents lepers, mother dead, father alive and residing in the Culion Leper Colony. One sister, S., nonleper, was sent away from Culion; another, L., 4 years old, now in Culion, has suspicious lesions which are bacteriologically negative.

G. was isolated in the Negative Children's House at the age of 1 year and 6 months, and was discharged two and a half years later, on account of the development of white nonanæsthetic areas, suspicious of leprosy. In June, 1921, she showed whitish areas all over the body and flushed, shiny, scaly legs; the white areas and the nose were bacteriologically negative. In September and November, 1921, the patches remained about the same (Plate 4, fig. 1), the scrapings from the spots and from the nose were still negative for *B. lepræ*; injection of 0.001 gram pilocarpine nitrate and administration of hot tea failed to elicit sweating in the white areas.

In February, 1922, the white areas all over the body showed reddish elevated borders (Plate 5, fig. 3), the face was reddish, and there were small nodules on both ears. The legs were still flushed and scaly. The

nodules of the ears and the reddish white patches were found bacteriologically positive, and the septum of the nose was negative.

The physical examination of the nose in February, 1922, showed catarrh, with the left side of the septum thickened, and the right side smooth and normal. A previous examination in November, 1921, gave negative findings on both sides of the septum of the nose (Table 2, No. 12).

III.—A.C. (Table 3, No. 13), Filipino, 8 years old, female, born in Culion in 1913. Both parents living and lepers, residing in the Culion Leper Colony. There are two sisters: P., 7 years old, nonleper, and C., 6 years old, and one brother S., 4 years old, who are considered clinically as lepers although they are bacteriologically negative.

A. was isolated in the Negative Children's House when 3 years old, and from there she was discharged after two and one-half years on account of the appearance of white patches which were suspicious of leprosy. There was no record made of the bacteriological findings at the time of her discharge.

At present she shows white areas, with red circular patches in the center, on both cheeks and chin (Plate 5, fig. 2); one extensive, faint, whitish area on the left scapular region; and several white, reddish areas on the left ulnar region. There are no nodules or infiltration of the ears. On the left ulnar region and on the posteroexternal surface of both legs there is both thermal and tactile anæsthesia. The legs are reddish and scaly, and there is ecthymatous itch over elbows, buttocks, thighs, and feet.

The nose, examined in November, 1921 (Table 2, No. 23), showed inner aspect of right ala nasi with ulcer; superficial ulcer, anterior portion of septum, left side; corresponding portion of right side slightly swollen and with scab.

The bacteriological examination in June, 1921, showed the nose negative and the skin positive; in November, 1921, both the nose and the skin were positive for *B. lepræ*.

IV.—A.M. (Table 3, No. 12), Filipino, 8 years old, female. Born in Culion. Both parents were lepers, now dead. No brothers or sisters. There is no reliable history obtainable on account of the death of the parents, but she says that the white areas appeared at the same time.

Her condition on February 20, 1922, showed whitish areas of different shapes and sizes on chest, abdomen, back, and loin. The buttocks and legs showed the same color as the whitish areas, indicating that they consist of white confluent areas. The face was red and infiltrated. Both ears showed small nodules. The legs were red, dry, and scaly. There was ulceration on the right leg. The left forearm was also scaly. The white areas were not anæsthetic, and in November, 1921, they showed sweating on administration of pilocarpine and hot tea. There is slight anæsthesia on the anterior surface of the left forearm, both to temperature and to touch. The infiltration of the face and the nodules on the ears were not present on former examinations in June and September, 1921, when her picture was taken (Plate 4, fig. 3). There is also ecthymatous scabies on both legs and abdomen.

The examination of the nose showed the right side of the septum with nodulelike swelling, the apex of which seems eroded and ulcerated, the left side of the septum being normal.

Bacteriological examinations repeatedly made, June to November, 1921, showed the skin positive and the nose negative. On February 20, 1922,



scrapings from lesions of the skin and the septum of the nose were positive for *B. lepræ*.

V.—E.R. (Table 3, No. 23), Filipino, 12 years old, female. Born in Culion. Both parents, now dead, were lepers. No brothers or sisters.

First lesions that appeared were two whitish areas on the back; later such areas became numerous and extensive; then nodules appeared, first on both elbows and knees, then on the hands and feet and, later, on the alæ nasi, chin, and ears (Plate 6, fig. 1).

Her condition on February 18, 1922, was briefly as follows: Nodules on ears, alæ nasi, chin, both elbows, and forearms, and nodular masses on hands and knees. Infiltrations on cheeks, both forearms, nates, thighs, legs, and feet. Extensive white areas on trunk and arms. Legs dry and scaly. Inguinal glands on both sides enlarged. Axillary glands not palpable. There was no falling out of eyebrows. The white areas in parts were denuded of hair, but in most cases the hair was normal.

Thermal and tactile anæsthesia on the ulnar region, both sides, and on both calves; thermal anæsthesia only on both elbows and tendo achillis; no thermal or tactile anæsthesia on the white areas.

The nose shows scabs and ulceration on both sides of the septum and on the left ala nasi; there was bleeding on detaching the scabs.

The bacteriological findings were positive for the white areas, nodules, and the septum of the nose.

VI.—F.S. (Table 3, No. 24), Filipino, 13 years old, male. Born in Culion. Both parents, now dead, were lepers. No brothers or sisters.

The disease commenced several years ago with anæsthesia on the elbows and on the knees. Later there was infiltration on both ears, and then the appearance of nodules. Two months ago numerous white areas appeared on the trunk (Plate 6, fig. 2). There has been no prodromal chill and fever; nor were there any paresthetic symptoms.

At present (February, 1922) there are typical nodules on the ears and on the right side of the alæ of the nose. There is infiltration on both cheeks. The femoral glands are greatly enlarged, and the inguinal and axillary glands are palpable. The small finger of the right hand is thickened but is not anæsthetic to touch. Both ulnar nerves are slightly thickened, but there is no tactile anæsthesia on the forearms. There is thermal and tactile anæsthesia on the thighs and in the neighborhood of the knees. The trunk and chest show white nonanæsthetic areas. The skin on both arms and legs is dry and scurfy.

The bacteriological examination was positive of smears made from the white areas, nodules, the juice aspirated from the left inguinal gland, and the septum of the nose.

The type of suspicious or definite leprosy lesions occurring among brothers and sisters of different ages is indicative of the period of development of leprosy and suggests that the white patches in the skin of children are either leprous spots or precursors of definite leper manifestations. The following notes on children of the same parents serve to verify this statement:

1.—"I." E., 11 years old, female, was previously suspicious, showing a thickening in the region of the Darwinian tubercle of the ear and a whitish area on the left side of the face which was slightly reddish;

later both the ear infiltration and the face area disappeared after injections with ethyl ester of chaulmoogra oil and sodium cacodylate. P., 7 years old, female, is a positive leper (Table 3, No. 10). G., 3 years old, female, is negative.

2.—“C.” J., 9 years old, female, is a positive leper (Table 3, No. 16). D., 8 years old, female, is a suspicious leper, showing white area on the right loin and shiny legs. M., 7 years old, female, is negative.

3.—“N.” R., 10 years old, female, is a positive leper (Table 3, No. 20). B., 7 years old, male, is negative.

4.—“C.” A., 8 years old, female, is a positive leper (Table 3, No. 13). P., 7 years old, female, is a nonleper. C., 6 years old, female, shows an extensive whitish area on and above right knee which is anæsthetic to temperature but not to touch. S., 4 years old, male, shows whitish areas on back, above both knees, and on the right knee.

5.—“D.” G., 5 years old, female, is a positive leper (Table 3, No. 6). L., 4 years old, female, shows small white spots on the right cheek and right arm, and flushed, shiny legs. S., 3 years old, female, sent away from Culion when about 5 months old.

6.—“R.” There are five living children of a leper mother and a healthy father. J., 30 years old, female, and M., 20 years old, female, are lepers living now in Culion. Three younger brothers, aged 10, 9, and 7 years, respectively, are nonlepers and live in Tarlac Province. The mother, living in Culion, has borne another child by a leper father and this one, M. G., 4 years old, male, is now a positive leper (Table 3, No. 4).

Lepre lesions occasionally disappear spontaneously, as has been observed in one child, P.B., 5 years old, male, who was isolated in the Negative Children's House and later was discharged for suspicious leprosy. In June, 1921, he presented a reddish infiltrated area on the left cheek which was bacteriologically positive, but on February 20, 1922, and without treatment, the infiltration was negative. In our records there are four other children that showed, on first examination, bacteriologically negative white patches, but eight months later some or all of the patches disappeared.

#### THE EFFECT OF SEGREGATION ON THE DEVELOPMENT OF THE DISEASE

Since 1913 fifty-one children were transferred from Culion for adoption outside of the island. The age of the majority on transfer was between 4 months and 3 years; only one was 4 years, and another was 10 years of age. The children at the time of transfer were negative, physically and bacteriologically.

So far three have been returned to the colony: two on account of leprosy, and one on account of the request of the father who is in the colony, as he thought the child was not being properly taken care of.

The two children returned for leprosy were the following: G.M., male, born in Culion February 1, 1912; transferred away on March 23, 1914, at the age of 2 years and 2 months; on



September 7, 1921, was admitted to San Lazaro Hospital, Manila, as a leper, maculo-anæsthetic type, and returned to Culion on November 17, 1921, at the age of 9 years. A.C., born in Culion on May 26, 1912; transferred on April 23, 1914, at the age of 1 year and 11 months; returned to the colony about May 17, 1917, at the age of 5 years, and at the present writing the disease is of the nodular and anæsthetic type.

Beginning with the year 1916, an effort has been made to segregate physically and bacteriologically negative children in a house located on the site reserved for the healthy residents of the colony. Since the implantation of this policy in March, 1916, to October 6, 1921, there were isolated 83 children, of which 22 remain negative, 25 have died, 5 were transferred outside of the colony, 5 were returned to the leper population for other diseases, and 26 were returned for leprosy or suspicious signs of leprosy. No records were made of the physical and bacteriological findings at the time of discharge of the children.

TABLE 4.—*Children isolated at the Negative Children's House as nonlepers and later returned to the colony on account of definite or suspicious signs of leprosy.*

[ (+) Positive clinically and bacteriologically.]

No.	Initials.	Date of birth.	Age on Jan- uary 1, 1922.	Age when isolated.	Age when definite or suspicious signs of leprosy developed.	Period of isolation.
			Y. m. d.	Y. m. d.	Y. m. d.	Y. m. d.
1	J. R. (+)	March 30, 1911	10 9 1	5 1 26	5 5 25	0 3 29
2	A. T. (+)	February 19, 1910	11 10 12	6 4 23	6 11 13	0 6 15
3	P. I. (+)	June 25, 1914	7 6 6	1 9 0	2 6 7	0 8 7
4	E. R. (+)	June 14, 1914	7 6 17	2 1 3	2 10 (?)	0 9 0
5	E. S. (+)	September 8, 1911	10 3 23	4 10 19	6 (?)	1 2 (?)
6	R. N. (+)	October 17, 1911	10 2 14	4 5 12	5 8 13	1 2 2
7	F. A.	January 20, 1919	2 11 11	1 4 0	2 7 18	1 3 18
8	A. F.	June 13, 1914	7 6 18	1 11 13	3 5 23	1 6 13
9	V. C.	September 8, 1913	8 3 23	2 10 9	4 6 25	1 8 16
10	L. de C.	February 20, 1913	8 10 11	3 3 6	5 0 27	1 9 21
11	A. V. S. (+)	November 8, 1913	8 1 23	4 3 12	6 7 10	2 3 16
12	F. R. (+)	August 21, 1916	5 4 10	1 0 7	3 4 25	2 4 12
13	G. D. (+)	April 3, 1916	5 8 28	1 4 24	3 9 7	2 4 13
14	A. N.	August 15, 1913	8 4 16	2 7 23	5 5 3	2 5 2
15	A. C. (+)	April 21, 1913	8 8 10	3 2 26	5 8 27	2 6 1
16	L. T.	November 11, 1913	8 1 20	2 4 14	4 11 14	2 7 0
17	G. M.	February 2, 1915	6 10 29	1 1 19	3 11 16	2 9 17
18	P. B. (+)	July 13, 1916	5 5 18	1 1 15	3 9 3	2 9 18
19	M. L.	April 26, 1915	5 8 6	0 10 29	3 8 22	2 9 28
20	M. Z.	January 16, 1909	12 11 15	7 10 24	10 11 24	3 1 0
21	J. C. (+)	February 24, 1912	9 10 7	4 4 23	6 7 21	3 2 28
22	M. C.	April 14, 1913	8 8 17	2 11 24	7 2 2	4 2 8

The 26 children discharged for leprosy or suspicious signs of leprosy were repeatedly examined during the period from June, 1921, to February, 1922, and 4 were found nonlepers, 11 showed suspicious signs of leprosy but were bacteriologically negative, and 11 were clinically and bacteriologically positive. A tabulation is given (Table 4) to show the age at which the suspicious or definite leprosy developed and the period of segregation before such development, that would indicate the minimum period of time at which a latent leprosy may manifest itself.

Glancing over Table 4, one notices that children isolated at as early an age as one year (No. 12) developed later signs of leprosy confirmed by bacteriological examination; and that definite leprosy may appear within a period of between four months (No. 1) and three years and three months (No. 21) after isolation. The two cases transferred outside of Culion and later returned as positive probably developed the disease much earlier than the date of their return, as they no doubt escaped detection for a long time. Several months or years may elapse, therefore, after contact or association with lepers has ceased, before suspicious or definite signs of leprosy develop.

#### INCIDENCE OF LEPROSY AMONG THE CHILDREN OF LEPEERS

Denney(2) has already published data regarding the incidence of leprosy among the children of lepers born in Culion. Our figures give the results of a general survey made in February and March, 1922, of all the children born and living in Culion up to December 31, 1921, and take into account other details not previously considered. The total number of children examined was 308, of which 153 were males and 155 females. The results are shown in Table 5. Both parents of practically all the children examined were lepers.

The children have been classified into positive lepers, clinical lepers, suspicious, and negatives or nonlepers. Positive lepers are those who show definite clinical signs of leprosy and in whom *Bacillus lepræ* has been demonstrated. Clinical lepers are those who are negative bacteriologically, but who show at least one of the following symptoms: (a) Anæsthesia in the ulnar or peroneal region which cannot be attributed to other diseases; or (b) whitish patches which show definite anæsthesia, either thermal only or both thermal and tactile; or reddish tint indicative of progressive changes; or which definitely show no sweating on pilocarpine injection, in contrast with the surrounding normal skin and its corresponding symmetrical area on the other



side of the body. The suspicious cases are those that are also negative bacteriologically, and show whitish patches which are not anæsthetic and which show definite or doubtful sweating on pilocarpine injection, or they may show only flushed shiny legs. Negatives, or nonlepers, are those who are bacteriologically negative and on whom no suspicious blemishes or lesions are found in the skin.

TABLE 5.—Incidence of leprosy in the children of leper parents.

Age in years.	Children examined.			Positive lepers.				Clinical lepers.			
	Males.	Fe-males.	Total.	Males.	Fe-males.	Total.		Males.	Fe-males.	Total.	
							P. ct.				P. ct.
Under 1	15	17	32								
1	25	17	42								
2	13	15	28						1	1	3.57
3	25	15	40	1		1	2.5				
4	19	20	39	1	2	3	7.69	5	2	7	17.9
5	9	8	17	1	1	2	11.76				
6	15	21	36	1	1	2	5.33	1	3	4	11
7	12	12	24	2	1	3	12.50	1	1	2	8.33
8	6	16	22		2	2	9.09	1	3	4	18
9	6	3	9	3	1	4	44.44				
10	5	3	8	2	1	3	37.50				
11		4	4		1	1	25				
12	1	4	5		2	2	40	1	1	2	40
13	2		2	1		1	50				
Total	153	155	308	12	12	24	7.79	9	11	20	6.4

Age in years.	Suspicious.				Negatives.			
	Males.	Females.	Total.		Males.	Females.	Total.	
				P. ct.				P. ct.
Under 1					15	17	32	100
1	3	3	6	11.904	22	14	36	85.71
2	2	2	4	14.27	11	12	23	82.14
3	9	4	13	32.5	15	11	26	65
4	5	6	11	28.2	9	9	18	46.15
5	2	4	6	35.29	6	3	9	52.94
6	7	3	10	27.7	6	14	20	55.55
7	1		1	4.17	8	10	18	75
8	1	4	5	22.72	4	7	11	50
9					3	2	5	55.55
10	1	1	2	25	2	1	3	37.5
11						3	3	75
12						1	1	20
13					1		1	50
Total	31	27	58	18.8	102	104	206	66.8

Analyzing the data in Table 5, we notice that the positive lepers number 24, or 7.79 per cent of the total number of children (308) examined; of these 12 are males and 12 are females. The clinical lepers numbers 20, or 6.4 per cent; the suspicious, 58, or 18.8 per cent; and the nonlepers, 206, or 66.8 per cent. The distribution between sexes is practically the same, except in the clinical lepers among whom there is a greater number of females.

The incidence of the disease is greater as the children grow older. Taking the cases of undoubted leprosy, the positive lepers, and separating the children into three age groups in order to get average data for comparison, we find that there are 19 children from 10 to 13 years of age, inclusive, of which 7, or 36.8 per cent, are positive lepers; 108 children from 5 to 9 years, inclusive, of which 13, or 12 per cent, are positive lepers; and 181 children under 5 years of age, of which 4, or 2 per cent, are positive lepers. The youngest child found positive was 3 years old; the youngest child only clinically a leper was 2 years old; and the youngest children with suspicious blemishes were 1 year old.

#### SUMMARY AND CONCLUSIONS

The children born of leper parents show about the same susceptibility to other morbid conditions as children of nonleper parentage. The mortality on account of congenital debility is higher than in children born in nonleper populations, but this greater mortality due to congenital debility is counterbalanced by the lesser mortality due to infantile beriberi, a disease that has practically disappeared in Culion on account of the exclusive use of unpolished rice as the staple article of diet.

Our data indicate that the most-frequent recognizable site of the early lesion of leprosy is the skin, and that the infection through this route is greatly favored, presumably, on account of the great prevalence of skin diseases among the children, which offer anatomical conditions favorable to the invasion of the lepra bacillus.

{ The most-frequent recognizable early lesion of leprosy is macular lesion of the skin. In Filipino children this manifests itself in whitish, fawn-colored patches, which at the beginning may not show the bacillus of leprosy or disturbances that may be attributed to the innervation of the affected region, such as diminution in the sense of touch, thermal discrimination, sensibility to pain, or disturbance in the secretory power of the sweat glands. Later, when nervous disturbances become appa-



rent, the sense of thermal discrimination—that is, ability to distinguish between hot and cold—is the first one affected.

The white patches, *macula alba*, are either precursors of other cutaneous or nervous leprous manifestations, or they themselves develop into definite progressive and bacteriologically positive leprous lesions with concomitant thermal and tactile anæsthesia and anhidrosis.

In a few instances we noticed the disappearance, without treatment, of leprous lesions that were either negative or positive bacteriologically.

Children that have lived in intimate contact with lepers for varying lengths of time may develop leprosy, several months or years after they were isolated from lepers. The shortest period in our series was four months, and so far the longest period was three years and three months after isolation.

The survey made of 308 children of leper parents born and living at the time in Culion Island show 24, or 7.79 per cent, positive lepers and 78, or 25 per cent, with suspicious or definite signs of leprosy though not bacteriologically positive. The leprosy in children affects both sexes about equally. The incidence of leprosy is in direct ratio to the age of the child: the older the child the greater the incidence. The youngest child found to be a positive leper was 3 years old, but suspicious blemishes have been found in children as young as 1 year of age.

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## ILLUSTRATIONS

[Photographs by E. Cortes, Bureau of Science.]

### PLATE 1. SINGLE SUSPICIOUS, WHITISH, BACTERIOLOGICALLY NEGATIVE AREAS

- FIG. 1. J.B., 2 years old. Whitish area on the right buttock. Photographed on March 3, 1922.
2. White area noticed one year ago on the left cheek of B.B., 4 years old. Photographed on March 3, 1922.
  3. White area on buttock, four years' duration, on A.T., 7 years old, female. Photographed on September 13, 1921.

### PLATE 2. FURTHER PROGRESS OF WHITE AREAS

- FIG. 1. A.L., 3 years old. White area on the external surface of the left thigh, of about eight months' duration, and white area on the left cheek, which are at present bacteriologically negative. Vaccination mark on the left arm. Photographed on March 3, 1922.
2. A. de L., 4 years old, female. White area on the right loin which is bacteriologically positive and is the only leprous lesion in this child. Photographed on March 3, 1922.
  3. T.R., 6 years old, male. White areas on the back of the left arm of two years' duration which are bacteriologically positive. They are the only leprous lesions found in this case. Adjoining the areas, there are lesions of chronic "itch" which might have predisposed to the development of the leprous lesions. Photographed on March 3, 1922.

### PLATE 3. DEVELOPMENT OF FLUSHED, SHINY, AND SCALY LEGS

- FIG. 1. L.D., female, 4 years old, bacteriologically negative at the time. Photographed on September 13, 1921.
2. G.D., female, 5 years old, sister of L.D. in fig. 1, also bacteriologically negative at the time. Photographed at the same time as fig. 1, September 13, 1921.
  3. A.M., female, 8 years old, who is bacteriologically positive. The scaliness of the legs is more marked. A trophic ulcer is also shown on the right leg. Photographed on September 13, 1921.

### PLATE 4. MULTIPLE WHITE LEPROUS AREAS

- FIG. 1. D. sisters. They are the children whose legs are shown larger in Plate 3, figs. 1 and 2. The older girl, G., five years old, shows white areas all over the body, and the younger one, L., 4 years old, faint whitish areas on the right side of chin and right arm. Both bacteriologically negative at the time. Photographed on September 13, 1921.

2. F.B., 7 years old. White areas all over the body which are bacteriologically positive and on injection of pilocarpine show no sweating. These patches appeared about one year ago and were preceded by a white area on the right cheek which was noticed when he was hardly over 1 year old. Photographed on March 3, 1922.
3. A.M., 8 years old. White areas of different sizes and shapes all over the body which appeared in crops and are bacteriologically positive. Ulceration on right leg and scaliness of the skin of both legs is shown more plainly in Plate 3, fig. 3. Photographed on September 13, 1921.

PLATE 5. PROGRESSIVE CHANGES IN THE LEPROUS PATCHES

- FIG. 1. C.B., 3 years old, male. White areas on face and chest and one white area on anterior-surface of the left forearm which recently showed reddening and infiltration and on which the number of bacteria found are more numerous than on the white spots. Photographed on March 3, 1922.
2. A.C., 8 years old. White areas on cheek, with red centers which developed later, indicating progressive changes. Bacteriologically positive in these lesions and in the nasal septum. Photographed on September 13, 1921.
  3. This is the older girl represented in Plate 4, fig. 1, who was examined and photographed about six months later. Now she shows reddening of the edges of the white areas, flushing of the face, and nodular infiltration of the ears. The red margins of the macules and the nodules of the ear are bacteriologically positive, although the septum of the nose still remains negative. Photographed on March 3, 1922.

PLATE 6. ADVANCED STAGES OF LEPROSY

- FIG. 1. E.R., 12 years old. Nodular lesions in the ears, chin, and alæ nasi, and white areas on the chest which preceded the infiltrative and nodular lesions. Bacteriologically positive in the skin lesions and nose. Photographed on March 3, 1922.
2. F.S., 13 years old. Nodules on both ears and infiltration on both cheeks. White areas on the chest appeared recently, after the development of infiltration and nodules. The skin of the chest and arms also shows scars and active lesions of an itchy disease of the skin other than leprosy. Bacteriologically positive in the skin and nose. Photographed on March 3, 1922.





PLATE I. SINGLE, SUSPICIOUS, WHITISH BACTERIOLOGICALLY NEGATIVE AREAS.







PLATE 2. FURTHER PROGRESS OF WHITE AREAS.



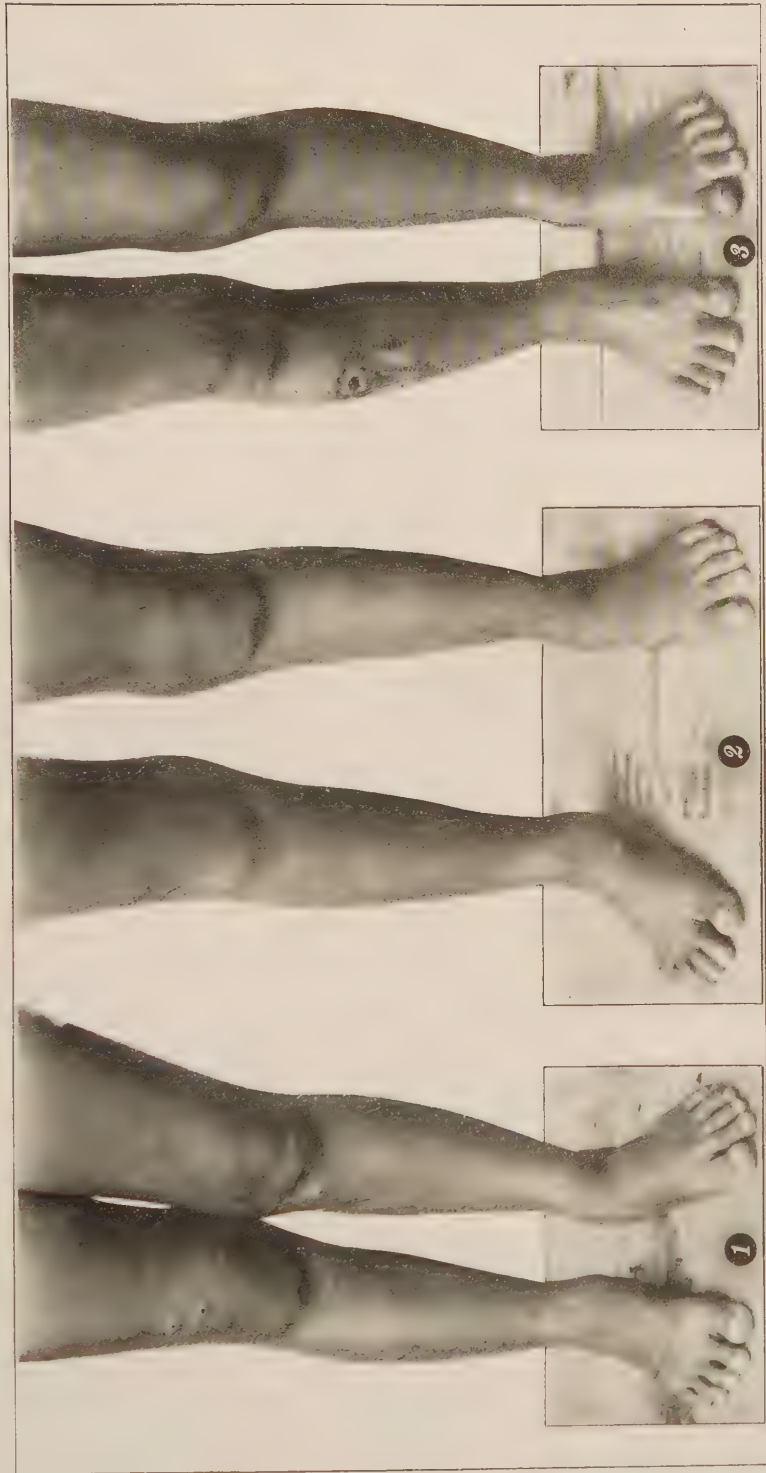


PLATE 3. DEVELOPMENT OF FLUSHED, SHINY, AND SCALY LEGS.







PLATE 4. MULTIPLE WHITE LEPROUS AREAS.







PLATE 5. PROGRESSIVE CHANGES IN THE LEPROUS PATCHES.





PLATE 6. ADVANCED STAGES OF LEPROSY.





# ADDITIONS TO THE HERPETOLOGICAL FAUNA OF THE PHILIPPINE ISLANDS, II

By EDWARD H. TAYLOR  
*Of Manila, Philippine Islands*

## FOUR PLATES

This paper contains descriptions of the following species believed to be new:

### AMPHIBIANS

<i>Rana igorota.</i>	<i>Cornufer rivularis.</i>
<i>Rana yakani.</i>	<i>Cornufer montanus.</i>
<i>Rana tafti.</i>	<i>Cornufer subterrestris.</i>
<i>Micrixalus diminutiva.</i>	<i>Polypedates linki.</i>

### LIZARDS

<i>Sphenomorphus beyeri.</i>	<i>Tropidophorus stejnegeri.</i>
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### SNAKE

*Natrix barbouri.*

The following species are listed with notes on color and scalation and other pertinent data:

### AMPHIBIANS

<i>Oxyglossis laevis</i> Günther.	<i>Polypedates pardalis</i> (Günther).
<i>Rana suluensis</i> Taylor.	<i>Polypedates appendiculatus</i> (Günther).
<i>Rana luzonensis</i> Boulenger.	<i>Kalophrynus stellatus</i> Stejneger.
<i>Rana sanguinea</i> Boettger.	<i>Bufo philippinicus</i> Boulenger.
<i>Rana erythræa</i> (Schlegel).	<i>Megalophrys stejnegeri</i> Taylor.
<i>Staurois natator</i> (Günther).	
<i>Cornufer corrugatus</i> (Duméril).	

### LIZARDS

<i>Lepidodactylus divergens</i> Taylor.	<i>Brachymeles gracilis</i> (Fischer).
<i>Lepidodactylus aureolineatus</i> Taylor.	<i>Brachymeles schadenbergi</i> (Fischer).
<i>Sphenomorphus luzonensis</i> (Boulenger).	<i>Brachymeles vermis</i> Taylor.
	<i>Dibamus argenteus</i> Taylor.

### SNAKES

<i>Natrix lineata</i> (Peters).	<i>Zaocys luzonensis</i> Günther.
<i>Natrix dendrophiops</i> (Günther).	<i>Holarochus meyerinkii</i> (Steindachner).
<i>Oxyrhabdium modestum</i> (Duméril and Bibron).	<i>Psammodynastes pulverulentus</i> (Boie).
<i>Oxyrhabdium leporinum</i> (Günther).	

*Boiga dendrophila divergens* Taylor.

*Hemibungarus calligaster* (Wiegmann).

*Hemibungarus meclungi* Taylor.

*Doliophis philippinus* (Günther).

*Naja naja philippinensis* Taylor.

*Naja naja samarensis* (Peters).

*Trimeresurus wagleri wagleri* (Boie).

*Rana guerreroi* Taylor has been relegated to the synonymy of *Rana luzonensis* Boulenger. The species was established on immature specimens but the study of a large series of larvæ, young, half-grown, and adult specimens obtained in 1920 makes this action imperative.

Under *Natrix barbouri* sp. nov., I have endeavored to show that *Natrix crebripunctata* (Wiegmann) should be eliminated from lists of Philippine snakes, since it is beyond question a name based on a young specimen of *Natrix spilogaster* (Boie).

#### AMPHIBIANS

##### *Oxyglossis lævis* Günther.

*Oxyglossis lævis* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 6, pl. 1, fig. A; TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 30.

I obtained specimens in Kalinga and Polillo; on Mount Mari-veles, Mount Banahao, and Mount Maquilung; at Zamboanga; and on Basilan. In each of these localities the species occurred in abundance. I failed to find specimens in Jolo. I have reported specimens from "Sulu Archipelago"<sup>1</sup> but fail to find in my records any mention of collections in Sulu. Usually where the species occurs it is very common and is the first species one picks up. It probably does not occur in Jolo.

Philippine specimens of this species appear to be larger than those from southeastern Asia. Many of my specimens are more than 50 millimeters long from snout to vent. Occasional specimens are more than 60 millimeters long. Published records from extra-Philippine localities give much smaller measurements. The tips of the digits appear to be more widened in Philippine specimens.

##### *Rana suluensis* Taylor. Plate 1, fig. 2.

*Rana suluensis* TAYLOR, Philip. Journ. Sci. 16 (1920) 264; Amphibians and Turtles of the Philippine Islands (1921) 65.

Two specimens of *Rana suluensis* were taken along a small stream in central Jolo, near the Government cattle ranch. The specimens agree very well with the type save in the presence of very distinct dorsolateral folds. Certain young cotypes, how-

<sup>1</sup> Loc. cit.



ever, had narrow folds. As the type has not been figured I include a photograph of one of the Jolo specimens, somewhat enlarged. The type locality is Tawitawi, an island to the south-west of Jolo.

*Rana luzonensis* Boulenger.

*Rana luzonensis* BOULENGER, Ann. & Mag. Nat. Hist. VI 17 (1896) 401; TAYLOR, Philip. Journ. Sci. 16 (1920) 254; Amphibians and Turtles of the Philippine Islands (1921) 55.

*Rana guerreroi* TAYLOR, Philip. Journ. Sci. 16 (1920) 255; Amphibians and Turtles of the Philippine Islands (1921) 56.

A number of specimens which I have referred to *Rana luzonensis* Boulenger were taken at Baguio and at various places along the trail to Bontoc. Larvæ were obtained near the Bontoc-Lepanto boundary from an old Bontoc fisherman, who had a small tin nearly filled with the larvæ. He had taken them for food, from a mountain stream near the trail. Larvæ and newly transformed young were taken at the town of Bontoc in the river and among the stones forming the walls of the rice paddies. A study of this series of larvæ and young and adult specimens has convinced me that my *Rana guerreroi* is the young of *Rana luzonensis*.

Measurements of *Rana luzonensis* Boulenger.

	No. 662.	No. 713.
	mm.	mm.
Snout to vent.....	58	53
Length of head.....	21	20
Width of head.....	17	14
Diameter of eye.....	6.7	6.5
Eye to end of snout.....	9.5	9
Eye to nostril.....	6	5.3
Upper eyelid.....	5	5
Interorbital space.....	5	5
Forelimb.....	39	34
Longest finger, with hand.....	19	15
Hind limb.....	109	97
Femur.....	32	30
Tibia.....	36.5	32
Longest toe, to metatarsal tubercle.....	32	25

*Color in life.*—(No. 662.) Above grayish to yellow-brown, with numerous blackish flecks on back; a black loreal streak and a black-brown tympanic spot; a brown spot near insertion of arm on underside; a light yellowish line from under eye to angle of mouth; limbs strongly barred with dark brown; chin and throat uniform purplish, growing brown on belly; soles dark with lighter tubercles; underside of arm cream, without spots.

The specimens vary considerably among themselves in color; one specimen (No. 718) is uniform reddish to red-brown above, posterior part of belly yellow to yellow-green, anterior part of throat and chin cream white.

Two other specimens were somewhat yellow-brown to olive above, with subarticular tubercles cream yellow. In one specimen (No. 664) the black spots are wanting on the side of the head.

The adult specimens were taken in various localities. One specimen was on the trunk of a growing tree concealed in moss, at a distance of about 2 meters from the ground. Three specimens were found in a rotten log lying across a small mountain brook, 14 kilometers north of Baguio near the trail. Young specimens were taken under stones near small brooks and rivers.

*Rana igorota* sp. nov. Plate 3, fig. 1.

*Type*.—No. F786, E. H. Taylor collection; collected April 28, 1920, at Balbalan, Kalinga Subprovince, northern Luzon, by E. H. Taylor.

*Description of type*.—Choanæ moderate, rather hidden by overhanging jaw; vomerine teeth in two series lying between and behind choanæ, separated from latter by a distance equal to length of one series, separated from one another by a distance somewhat less; tongue large with two elongate horns widely separated at base; snout elongate; head much longer than wide; eye a little shorter than snout; nostril nearer end of snout than eye; loreal region nearly perpendicular, strongly concave; tympanum large, separated from eye by a distance less than half the diameter of tympanum; distance between nostrils slightly greater than their distance from eye; interorbital distance equal to or a little less than upper eyelid; skin on head smooth; no tubercles on eyelids; back smooth save in posterior part where there are small scattered tubercles; a very narrow, distinct, tubercular, dorsolateral, glandular fold present; a glandular fold below tympanum turning down at its posterior end and terminating in a tubercle; upper surface of tibia with strong, scattered tubercles; belly granular in posterior part; chin and throat smooth; posterior and inferior aspects of femur largely granular; fingers with very broad disks, equal to two-thirds the diameter of tympanum, on the two outer fingers; disks smaller on the two inner fingers; first finger greatly thickened at base, distinctly shorter than second; subarticular tubercles distinct; palmar and carpal tubercles rather dim; toes with well-

developed, somewhat pointed disks about the size of that on the second finger; toes about four-fifths webbed, the web reaching fourth toe disk by only a very narrow membrane; sub-articular tubercles strong; an elongate outer and a small rounded inner metatarsal tubercle; a narrow skin fold on outer side of fifth toe, and on foot; a mere suggestion of a fold on forelimb; hind limb brought forward, the tibiotarsal articulation reaches about halfway between eye and nostril. The type specimen is a female, without vocal sacs.

*Color in life.*—Above, body green to olive green variegated with numerous rounded bronze spots; sides yellow-green, spotted with olive; belly yellow; lores dark olive; tympanum brown; limbs strongly barred with green and bronze; pads on toes cream yellow; dorsolateral glandular folds golden yellow.

*Measurements of the type of Rana igorota sp. nov.*

	mm.
Snout to vent	60
Length of head	22
Width of head	18
Length of snout	10
Diameter of eye	8.2
Upper eyelid	6.5
Interorbital area	5
Tympanum	5.5
Forelimb	38
Longest finger, with hand	17
Hind limb	99
Tibia	30
Femur	32
Longest toe, to metatarsal tubercle	25

*Variation.*—There is considerable variation in markings. In some specimens the rounded spots on the back are dim or almost wanting; likewise the spots on sides. Some of the younger specimens were nearly yellow in life. The distinctness of the granules on back and femur varies. There are nine cotypes, but I fail to find vocal sacs in any of them. Two or three specimens have minute spinelike tubercles on the lower jaw, throat, and breast, and in the area about tympanum. This may be a sexual variation.

*Remarks.*—This species is related to *Rana luzonensis* but differs materially in numerous characters. The hind limb is shorter in *R. igorota*, the tibiotarsal articulation reaching no farther than the nostril, while in *R. luzonensis* it reaches far beyond the tip of the snout. The snout of *R. igorota* is less flattened, the interorbital area narrower, and the disks on the toes



are slightly wider than in *R. luzonensis*.<sup>\*</sup> The color and markings are strikingly different.

Specimens of this species were collected only at Balbalan, Kalinga, on the edge of a small brook. When disturbed they dived in the brook and hid under rocks at the bottom, where they were captured.

The name of the species is derived from Igorot, the generic name applied to the peoples inhabiting the central part of northern Luzon.

*Rana yakani* sp. nov. Plate 1, fig. 1; Plate 2, fig. 1.

*Type*.—No. 1545, E. H. Taylor collection; collected at Abung-abung, Basilan, October 22, 1920, by E. H. Taylor.

*Description of type*.—Choanæ moderately large, partially concealed by overhanging jaw; vomerine teeth in two small oblique series; separated from choanæ by a distance equal to length of one series, the two series separated by a similar distance; teeth extend much beyond posterior border of choanæ, and do not or scarcely reach anterior border; tongue broad, cordiform, with two rounded horns behind, very narrowly separated at base; a prominent tubercle on tongue, head rather bluntly pointed; snout extending beyond lower lip; canthus rostralis distinct, rounded; loreal region nearly perpendicular, deeply grooved behind nostril; eye large, diameter of orbit very slightly less than its distance from tip of snout; nostril nearer end of snout than eye; interorbital distance a little less than width of upper eyelid; distance between nostrils equals their distance from eye; tympanum large, distinct, equal to about three-fifths orbit; strong, broad, dorsolateral folds from eye to near anus, converging somewhat posteriorly; no supratympanic fold or, if present, indistinct; upper lip glandular; a glandular fold at corner of mouth and another above insertion of arm; skin on back heavily covered with small granules; snout more or less smooth; upper eyelid granular; granules on limbs arranged in dim longitudinal lines; sides with numerous enlarged tubercles; throat and belly smooth; posterior and inferior aspect of femur strongly granular; a deep elongate groove in middle of back between shoulders; fingers slender, elongate, with distinct disks on tips, about one and one-fourth to one and one-half times as wide as finger; subarticular tubercles strong; carpal and palmar tubercles distinct; first finger distinctly longer than second, extending as far as fourth; no gland on arm; toes with disks larger than those on fingers; disks on both fingers and toes rather pointed; toes about two-thirds webbed, the web reaching

to near disk on outer side of third and inner side of fifth, not more than halfway on first toe, and slightly in advance of the penultimate subarticular tubercle on fourth; subarticular tubercles strong; no tubercles on sole; very strong, inner, metatarsal tubercle and a strong outer one which is only very little smaller than the inner; no fold on outer side of fourth toe of foot; the leg brought forward the tibiotarsal articulation reaches anterior corner of eye or a little farther.

*Color in life.*—Above olive to bronze brown with darker brown spots and mottlings; dorsolateral glandular fold lighter olive bordered below by a black-brown line; loreal region with a broad band of black-brown; tympanum and side of head dark brown with a lighter area behind eye; sides with yellow tubercles, low on side; belly cream to yellow; limbs strongly barred and mottled with brown; web of foot blackish; fold at corner of mouth yellow.

*Measurements of Rana yakani sp. nov.*

	No. 1545, ♀	No. 1603, ♀	No. 1027, ♂
	mm.	mm.	mm.
Length, snout to vent.....	67	65	48
Length of head.....	24	24	20
Width of head.....	21	21	16
Snout.....	10	9.8	8.5
Eye to nostril.....	6.5	5.5	5
Upper eyelid.....	6	6	6
Diameter of eye.....	9.2	9.3	8
Interorbital distance.....	5	5.5	4.5
Tympanum.....	6	6	5.5
Forelimb.....	38	38	30
Longest finger, with hand.....	17	16	13.5
Hind limb.....	104	98	74
Femur.....	31	29	23
Tibia.....	35	34	25
Longest toe, to metatarsal tubercle.....	28	27	21

*Variation.*—The sexes vary greatly in size. The largest female (No. 1065), from Zamboanga, measures 75 millimeters from snout to vent; the largest male, also from Zamboanga, measures 48 millimeters from snout to vent. There is a certain amount of variation in the size of the eye and the tympanum, and in the distinctness of the granulation on the back. Males are for the most part smoother than females. The groove on the back is invariably present. The tubercle on the tongue is distinct in some specimens and dim or wanting in others. In color, they vary from yellow olive to deep bronze. Males are usually much lighter in color than females. Young females

are usually deeper brown than older specimens, and the sides of the head and body are frequently black. Many specimens have the belly and throat strongly mottled with dusky.

*Remarks.*—Only two specimens were obtained at Zamboanga along Tumugao River. None were found at Isabela or Port Holland on Basilan, but this species was not uncommon at Abung-abung in the southern part of the island. Females were usually found in the forest at a considerable distance from water. Most of the males were collected in a small forest stream at a point where a tree top had fallen into the water. More than fifty males and but one or two females were captured there.

The species appears to be related to *Rana erythræa* of the Philippines. It differs in markings, in the greater amount of granulation on the back, in having much larger eyes, in the narrower interorbital distance, and in having transverse bars instead of longitudinal lines on the femur and tibia; the outer metatarsal tubercle is very strong. The last character is wanting in the continental and Malayan *Rana erythræa*, but a small tubercle is evident in specimens supposed to be of this species from Negros and Sibuyan. The name for the species is taken from the tribe of people inhabiting the interior of Basilan.

*Rana sanguinea* Boettger.

*Rana sanguinea* BOETTGER, Zool. Anz. 16 (1893) 364; TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 60.

Specimens of this species were obtained in Busuanga, by Gregorio Lopez, of the Bureau of Science. The specimens are not full grown. The body is reddish brown above, and dark on the sides. The characteristic black mark covering the tympanum is well defined. The throat is dusky with an elongate streak under the point of insertion of the arm, and there are two spots on the back part of the throat.

*Rana erythræa* (Schlegel).

*Hyla erythræa* SCHLEGEL, Abbild. Amph. (1837) 27, pl. 9, fig. 3.

*Rana erythræa* TAYLOR, Philip. Journ. Sci. 16 (1920) 249, pl. 1, fig. 2; text fig. 1; Amphibians and Turtles of the Philippine Islands (1921) 50, pl. 1, fig. 2; text fig. 1.

Specimens of *Rana erythræa* were recently collected on Sibuyan Island. I have also specimens collected in Negros. British Museum specimens from the Philippines bear only the label "Philippines." Fischer,<sup>2</sup> records a specimen from southern Mindanao collected by Doctor Schadenberg in 1881. No other col-

<sup>2</sup> Jahrb. wiss. Anst. Hamburg 2 (1885) 80.



lector has found the species in Mindanao. It would appear that this frog is of very erratic distribution in the Islands. Philippine specimens differ from the ordinary Malayan and continental forms in having a small but distinct outer metatarsal tubercle, a character which alone does not appear to warrant separating the Philippine form under a new name.

*Rana tafti* sp. nov.

*Type*.—No. 1849, E. H. Taylor collection; collected in mountains near the Pacific coast of Luzon on the trail between Famy, Laguna Province, and Infanta, Tayabas Province, by Lyman H. Taft and F. X Williams.

*Description of type*.—Choanæ moderate, partly concealed by overhanging jaw, the distance between them equal to distance from eye to nostril; vomerine teeth in two small, rather rounded, nearly transverse series lying between the choanæ, separated from choanæ and from each other by an equal distance; tongue with two prominent horns posteriorly, widely separated at base; no papilla on tongue; no vocal sacs (probably a female specimen); head much flattened, nostril much nearer point of snout than eye; diameter of orbit equal to distance from nostril; eyes prominent, the upper eyelid slightly less than interorbital distance; distance between nostrils about equal to interorbital distance; tympanum very distinct, very large, longer than high, its length equal to diameter of orbit, separated from orbit by a distance less than one-fourth its length; loreal region perpendicular; a groove behind nostril; canthus rostralis sharply angular; snout rather conical in front of nostrils; skin of head and body smooth or very faintly shagreened; posterior part of eyelid slightly granulate; two strong callous tubercles on head lying on upper, inner edge of eyelid near anterior part, and a small tubercle lying nearly between these; two low callous places in interorbital space; a very strong fold above tympanum which continues the length of the body as a very narrow dorsolateral fold; a very slight fold behind tympanum to arm; a broken glandular fold from angle of mouth to arm, very distinct; sides, breast, and throat smooth; posterior part of belly granular; undersurface of femur and anal region granular; fingers with well-developed disks, rather pointed anteriorly; first finger shorter than second; fourth reaches base of pad on third; no fold on arm; no web at base of fingers; subarticular tubercles very strong, protruding; toes about four-fifths webbed, the membrane failing to reach disks on inner side of second and

third toes, but reaching somewhat beyond penultimate subarticular tubercle on fourth; carpal tubercles prominent; subarticular tubercles on toes very strong; a very small metatarsal tubercle and a still smaller outer tubercle; third and fifth toes nearly equal; disks on toes pointed, much smaller than those on fingers; a slight skin fold on outer side of fifth toe, not continued on foot; no tubercle on heel; tibiotarsal articulation reaches considerably beyond tip of snout.

*Color in alcohol.*—Above blackish purple, nearly uniform; callous spots on head brown; tympanum brown; latter part of upper jaw whitish; an indistinct light spot under eye and in front of tympanum; arms and legs brownish, barred with darker color; underside of femur and tibia spotted brown; a spot on underside of arm near insertion; throat and belly light; purplish spots low on sides.

*Measurements of the type of Rana tafti sp. nov.*

	mm.
Snout to vent	42
Length of head	18
Width of head	11.5
Diameter of tympanum	5
Diameter of eye	5
Upper eyelid	4
Interorbital distance	4
Eye to nostril	5
Length of snout	7
Depth of head in front of eyes	3.5
Depth of head at tympanum	4.3
Forelimb	27
Longest finger, to wrist	15
Hind limb	73
Femur	22.5
Tibia	24
Longest toe	21

*Remarks.*—The species is most closely related to *Rana mearnsi* Stejneger from Mindanao, from which it differs in having a longer, narrower, more-flattened head, a larger tympanum of different shape, and smaller toe disks. In the shape of the tympanum it is similar to *Rana merrilli* Taylor but lacks the folds below the anus and differs in measurements. The head is more pointed, and the head and body appear flatter.

When I first examined this specimen I suspected that it was the very rare *Polypedates hecticus*. There is no distinct notch in front of the pad as is present in Philippine species, and dissection of the fourth finger failed to reveal any intercalated bone.

The species was discovered by Mr. Lyman H. Taft and Dr. F. X. Williams, and is named for the former in recognition of his kindness in collecting and presenting to me this and numerous other valuable specimens.

*Micrixalus diminutiva* sp. nov. Plate 1, figs. 3 and 4; Plate 2, figs. 2 and 3.

*Type*.—No. 1066, E. H. Taylor collection; collected near Pasananka, Zamboanga, Mindanao, November 10, 1920, by E. H. Taylor.

*Description of type*.—Choanæ small, widely separated, concealed under overhanging jaw; no vomerine teeth present; tongue very small, without tubercular papilla on tip, very slightly notched behind; apex of lower jaw with a single, toothlike prominence; head short, snout blunt, nostril about midway between eye and tip of snout; eye large, the diameter of orbit distinctly longer than snout; loreal region nearly perpendicular or slightly sloping; canthus rostralis rather indistinct, rounded; a very shallow depression behind nostril; tympanum with only a slight edge visible; a fold from eye running in a straight line to behind angle of mouth, then curving up to above insertion of arm; a glandular area behind angle of mouth; upper eyelid about one and one-fifth times interorbital space; skin above smooth, very minutely shagreened or corrugated; eyelid with a distinct tubercle; a dorsolateral glandular fold begins behind eye and continues more than half the length of body, more prominent anteriorly; this fold is widely separated from the supratympanic fold at its beginning; sides with numerous pustular tubercles, one above arm most prominent; belly and underside of limbs smooth; arms short, fingers small, the tips not or very slightly dilated; the palm very thick; subarticular tubercles nearest palm well defined, outer ones less strongly defined; first finger as long as second and fourth; carpal tubercles flat, indistinct; no web between fingers; indistinct tubercles on outer side of arm; toes about two-thirds webbed, the membrane reaching disk of first and second toes on the outer side and to near disk on the inner edge of fifth; a strong inner metatarsal tubercle; outer very dim, situated at the end of a flap of skin which is on the outer side of fifth toe; a slight fold on heel behind inner metatarsal tubercle; the leg brought forward tibiotarsal articulation reaches to between eye and tip of snout. (Males with two internal vocal sacs, the openings small.)

*Color in life*.—Above a broad chestnut brown stripe from tip of snout to anus, widening posteriorly; the rest of back and sides

pinkish lavender; two chestnut brown stripes corresponding to the dorsolateral glandular folds extend from eye to shoulder; limbs barred with chestnut brown; brown spots partially separated by yellowish spots on side of head; a yellowish streak from eye to angle of jaw; dark marking low on sides and on groins; belly flesh-colored; chin and throat with scattered brown spots; undersurface of hands and feet purplish.

*Measurements of the type of Micrixalus diminutiva sp. nov.*

	mm.
Snout to vent	21
Length of head	8
Width of head at tympanum	8
Length of snout	2.6
Diameter of eye	3.4
Upper lid	1.8
Interorbital space	2.2
Forelimb	12
Longest finger, to wrist	6
Hind limb	39
Tibia	11
Femur	11
Longest toe, to metatarsal tubercle	12

*Variation.*—Several cotypes from the same immediate locality agree with the type in general contour but some have the color pattern much less distinct; in certain specimens the broad dorsal stripe forms three branches posteriorly, one branch ending at the anus, the others being carried across the groin to the femur and tibia. In one specimen, the broad stripe is shaped like an hourglass. A single specimen taken near Abung-abung, Basilan, agrees very well, save that there is a median yellow hair line from snout to anus.

Some twenty specimens collected on Jolo Island differ markedly from the Zamboanga forms. The bodies are for the most part slenderer, the throats are very dark purple (some almost uniform) to halfway on belly. The web is more deeply excised between the toes, particularly between the fourth and fifth which are less than half webbed. The color patterns on the Jolo specimens vary considerably; at least one-fourth have the median hair line yellow in color; some specimens are brownish above, some gray to lavender. The characteristic marking of the type is present in some of the female specimens.

At first I was inclined to regard the Jolo specimens as a distinct species, but as the only tangible difference that held throughout the series was the lesser amount of webbing between the outer toes, I placed both groups under the same name.



*Remarks.*—This is the first record of this genus for the Philippines. I have no doubt that it is rightly associated with this group, in spite of the fact that it has not been reported from the Malay Peninsula nor from the Archipelago. When I first collected the specimens I thought them probably a new species of *Oxyglossis*. The slightly bifid tongue, the character of the toes, and the presence of the single toothlike prominence at the apex of the lower jaw preclude the possibility of this association.

Annandale<sup>3</sup> describes a small frog, *Micrixalus borealis*. He mentions the presence of "a jaw," which is characteristic of this species. The dorsolateral glandular fold, which is characteristic of most Indian species as well as of the species here described, is wanting in his species.

*Staurois natator* (Günther).

*Ixalus natator* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 15, pl. 4, fig. c.

*Staurois natator* TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 78.

I collected many specimens of this species at Zamboanga and on Basilan, but found none in Jolo. Gregorio Lopez collected specimens at Cabalian, Leyte.

The Leyte specimens vary markedly in color from the others. Several of the specimens are uniform olive above; in others the color above is blackish with well-defined silver white spots. Seven among eighteen specimens have a distinct tubercle on the tongue.

The Zamboanga and the Basilan specimens are bronze to olive green, usually mottled above with silvery gray to green. The tubercle on the tongue is present in about two-thirds of the specimens, and dim or wanting in the others. The granulation on the back varies considerably. Some specimens are nearly smooth; others strongly granular, with occasional larger tubercles.

*Cornufer corrugatus* (Duméril).

*Hylodes corrugatus* DUMÉRIL, Ann. Sci. Nat. III 19 (1853) 176.

*Cornufer corrugatus* TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 115.

*Platymantis corrugata* BOULENGER, Ann. & Mag. Nat. Hist. IX 1 (1918) 373.

I collected this species on Polillo and on Mount Maquiling, Laguna Province, Luzon. I failed to obtain it in any other

<sup>3</sup> Rec. Ind. Mus. 3<sup>1</sup> (1912) 10 (8 of author's separate), pl. 2, fig. 2.

place. It has a wide distribution in the islands southeast of the Philippines. It probably occurs in all of the larger islands of the eastern Philippine group, since specimens have been taken in Mindanao, Negros, Luzon, and Polillo. It is very probably absent from the Sulu and the Palawan groups. The specimens vary greatly in color and markings. The regular folds on the back and the dark lores make the form easily recognizable.

*Cornufer rivularis* sp. nov. Plate 4, fig. 3.

*Type*.—No. 761, E. H. Taylor collection; collected April 25, 1920, at Balbalan, Kalinga Subprovince, northern Luzon, by E. H. Taylor.

*Description of type*.—(Adult female.) Choanæ rather large, widely separated; vomerine teeth in two oblique, converging series lying between and almost wholly behind choanæ, separated from the latter by a distance equal to half the length of one series and separated medially by a distance as great as the length of one series; tongue moderately wide with two small rounded horns behind and an indistinct tubercle on anterior part; head about as long as broad; canthus rostralis distinct; top of head strongly curved, longitudinally, to tip of snout; eye moderate, the diameter of orbit equal to or slightly greater than distance from eye to nostril; interorbital space at least one and one-half times the width of upper eyelid; tympanum small, indistinct, apparently covered with skin, its diameter equal to about one-third to one-half the diameter of orbit; a distinct supratympanic fold curves from eye to above insertion of arm; a slight fold curves upward across angle of mouth; head, upper eyelid, and skin on back and sides smooth with no trace of granules or tubercles; throat and chin smooth; posterior part of belly with large mosaiclike granules; area about anus granular; fingers with tips dilated into large disks, much larger than tympanum; disks on two outer fingers much larger than those on inner fingers, which appear to be opposed to the two outer; first very much smaller than second; subarticular tubercles large, distinct; three distinct carpal tubercles; tips of toes widened into distinct disks, smaller than those on outer fingers; a small, but distinct web at base of toes; third and fifth toes of equal length, or the third slightly longer; inner metatarsal tubercle elongate, low, dim; outer small, rounded; subarticular tubercles moderately distinct; none or only a dim fold on outer side of fifth toe, a distinct spinelike tubercle on heel; the leg

brought forward the tibiotarsal articulation reaches to near nostril.

*Color in life.*—Dorsal surface, from extreme tip of snout to anus, light gray; small, scattered, deep black dots and blotches on back, with a large prominent blotch on shoulders; gray area of back edged with blackish laterally; loreal region and sides of head and body dusky; belly and throat whitish, with brown flecks on belly; groin, thighs, femur, hand, and foot yellow; upper lip with a few indistinct yellowish marks.

*Measurements of the type of Cornufer rivularis sp. nov.*

	mm.
Length, snout to vent	26
Width of head	10
Length of head	11.5
Length of snout	5
Diameter of orbit	3.6
Interorbital distance	3.4
Upper eyelid	2
Tympanum	1.4
Forelimb	19
Longest finger, with hand	9
Hind limb	43
Femur	13
Tibia	14
Longest toe, to metatarsal tubercle	13

*Variation.*—Five other specimens were taken, all more or less resembling the type in markings and color. One specimen (No. 759) had a large red blotch on the groin. When preserved the markings of most of the specimens changed. The gray area on the back disappeared, and the entire body assumed a brownish color, with two longitudinal dark markings running parallel on the back from occiput to middle of back and two short longitudinal marks on sides ending near the groin. The tubercle on the tongue is more or less distinct in all the specimens.

One of the specimens (No. 760, length 23 millimeters) is full of eggs. These are yellow and are very large, measuring from 3 to 3.5 millimeters in diameter.

The males have vocal sacs; the opening is situated near the angle of the jaws.

*Remarks.*—The specimens were taken in the small brook, just behind the town of Balbalan, which furnishes water to the town. They were seated on the leaves of a plant growing over the running water. Instead of jumping when I approached, they merely crouched close to the edges of the leaves in which posi-

tion they were picked up. *Cornufer cornutus* was taken in this same shrub.

The species belongs to the section of the genus characterized by the flattened fingers dilated into disks at the tips. I state above that the first and second fingers appear to oppose the other two. This is true in three of the specimens, but in the others the apparent apposition is not so plainly marked. It does not appear to be closely related to other Philippine species.

*Cornufer montanus* sp. nov. Plate 4, fig. 4.

*Type*.—No. 861, E. H. Taylor collection; collected May 31, 1920, at an elevation of about 1,500 meters on Mount Banahao, Laguna Province, Luzon, by E. H. Taylor.

*Description of type*.—Choanæ moderate, not concealed by overhanging jaw; two small groups of vomerine teeth lying between and behind choanæ, beginning near inner posterior edge of choanæ and converging backward, widely separated medially; distance between choanæ greater than distance between nostrils; canthus rostralis distinct; upper part of loreal region perpendicular, then sloping very obliquely to lip; tip of snout rather truncate, sloping obliquely to lip and not extending beyond lower jaw; nostril nearer tip of snout than eye; diameter of orbit equal to length of snout; upper eyelid equal to or slightly wider than interorbital area; tympanum covered with skin, dim, small, a little more than one-third the diameter of orbit, separated from orbit by a distance equal to more than half its diameter; upper eyelid with two large flattened tubercles; a pair of tubercles on back of head, and another pair on shoulders; skin on back and limbs smooth; loreal region slightly granular; a supratympanic fold begins behind eye and curves downward over upper edge of tympanum to insertion of arm; another slight fold curving up across angle of mouth, crossing lower part of tympanum; a strong tubercle on heel; chin, throat, and belly strongly granular; anal region with strong granules; no dorsolateral glandular folds; hand with three outer fingers flattened, the tips dilated into strong disks at least twice as wide as finger; subarticular tubercles strongly defined, large, rounded, and flattened; small palmar tubercles, three carpal tubercles moderately distinct, with a fourth somewhat behind these on wrist; inner finger small, not dilated at tip, and less flattened than the others; toes flattened and dilated at tips, the disks not more than one and one-half times the width of digit; subarticular tubercles large, flat, not strongly defined; a slight rudiment of web be-



tween toes, third toe longer than fifth; an inner and an outer metatarsal tubercle; no skin fold along outer toe to heel; the hind limb brought forward the tibiotarsal articulation reaches to near anterior corner of eye; opening of vocal sac near angle of mouth; tongue with two horns posteriorly and a large tubercle anteriorly.

*Color in life.*—Above gray-brown, variegated, with a broad median cream yellow stripe from tip of snout to anus; bars on legs dull cream to white; side and groin with large, bright, lemon yellow spots, separated by narrow lines of brown; belly and chin flesh-colored, mottled with brown; underside of limbs with large islandlike white or yellow spots; toes barred with cream; a narrow indistinct line from eye across tympanum and angle of mouth. Loreal region dark brown, mottled slightly with lighter.

*Measurements of the type of Cornufer montanus sp. nov.*

	mm.
Snout to vent	28.5
Length of head	12
Width of head	11.5
Upper eyelid	3
Interorbital distance	3
Eye to end of snout	5
Diameter of eye	5
Eye to nostril	4
Forelimb	18.5
Longest finger, with hand	10
Hind limb	45
Femur	12.5
Tibia	15
Longest toe, to metatarsal tubercle	12.5

*Remarks.*—The type was collected at an elevation of nearly 1,500 meters, on Mount Banahao, on small shrubs growing out from a perpendicular cliff. Only the type was found. This species appears to be related to *Cornufer worcesteri* and *C. guentheri*. From the former it differs in having a papilla on the tongue, the eye being larger in proportion to the length of the snout, the upper eyelid equaling the interorbital distance, the tympanum being one-third the diameter of eye, and the tibiotarsal articulation reaching only to the eye instead of to the nostril. The color and markings are essentially different. From *C. guentheri* it differs in color, in the presence of a large tubercle on the heel, and in the absence of one on the angle of the jaws. There are numerous other differences.

*Cornufer subterrestris* sp. nov.

*Type*.—No. 707, E. H. Taylor collection; collected near kilometer 101, on the Mountain Trail, Mountain Province, Luzon, April 17, 1920, by E. H. Taylor.

*Description of type*.—Male. Choanæ small, very far forward and near to each other, not concealed by overhanging jaw; vomerine teeth very dim, represented by a rugose area somewhat between and behind choanæ; tongue elongate, with two posterior horns, which are very narrowly separated at base, and a tubercle on the anterior part; openings to vocal sacs elongate slits near angle of jaws; top of head rather curving forward; canthus rostralis distinct; upper part of loreal region slightly oblique, lower part strongly oblique; nostrils about halfway between orbit and extreme point of snout; eye large, diameter of orbit equal to or very slightly less than length of snout; interorbital area nearly double upper eyelid; distance between nostrils much less than interorbital distance; tympanum moderately distinct, about two-fifths diameter of orbit; skin of head smooth; no tubercle on eyelid; apparently no supratympanic fold; skin on back and sides smooth (in the middle of the back the skin is puckered and drawn forming a small blind sac; this appears to be a normal condition); skin of chin and throat smooth, that on belly very indistinctly granular; area about anus very dimly granular; fingers somewhat flattened, the tips dilated into disks, those of the two outer fingers larger than those of the two inner; subarticular and carpal tubercles rather indistinct; toes slightly flattened, with very small disks; a slight web at base of toes; third toe longer than fifth; subarticular tubercles rather dim; inner metatarsal tubercle present; outer, if present, very dim.

*Color in life*.—Above purplish without markings on head; sides dark purplish brown with large rounding spots of cream to yellow, more prominent on groin and axilla; upper part of limbs purplish; on sides and below with large, cream-yellow, irregular spots; throat dusky; belly dusky, reticulated with cream.

*Measurements of the type of Cornufer subterrestris* sp. nov.

	mm.
Snout to vent	25
Length of head	11
Width of head	10.5
Snout	4.8
Diameter of orbit	4.8
Interorbital distance	4
Upper eyelid	2
Tympanum	1.9

Measurements of the type of *Cornufer subterrestris* sp. nov.—Continued.

	mm.
Forelimb	16
Longest finger, with hand	8
Hind limb	38
Tibia	11
Femur	12
Longest toe, to metatarsal tubercle	12

*Remarks.*—The type specimen has been injured by rubbing, after having been preserved, and there is some doubt as to the correctness of certain minor characters. However, the species is very distinct, and I have no hesitancy in describing it from a single specimen.

After a very heavy rain and hail storm I heard the frogs in the small gullies along the mountain trail. I endeavored to locate them by following up their thin, high-pitched voices. Although the frogs were very close to me, I could not find them. Later in the afternoon several were heard on the bank of a small mountain stream which crosses the trail near kilometer 101. The bank was covered with moss. I stood in the icy water and began to dig in the bank; after half an hour's work, realizing that I must reach camp before dark, I gave up. On starting to pick up my gun, which I had laid on a narrow ledge, I found the tiny frog sitting on my gun stock.

The species apparently belongs in the genus *Cornufer*, although I do not feel wholly certain. More material may warrant a different generic designation. The vomerine teeth are different from those of other species of *Cornufer*—in fact, I am not certain that the slightly rugose area should really be regarded as vomerine teeth.

*Polypedates pardalis* (Günther).

*Rhacophorus pardalis* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 83.

*Polypedates pardalis* TAYLOR, Philip. Journ. Sci. 16 (1920) 281, pl.

4, fig. 1; pl. 6, figs. 2 and 2a; Amphibians and Turtles of the Philippine Islands (1921) 82, pl. 4, fig. 1; pl. 6, figs. 2 and 2a.

Specimens of this species were collected at Balbalan, Kalinga, northern Luzon; on Polillo Island; and at Port Holland, Basilan. Four Kalinga specimens were collected at night on April 28, from rain pools in which they were breeding. *Kaloula rigida* Taylor and *Polypedates leucomystax* (Gravenhorst) were breeding in the same pools.

When first taken, the specimens were nearly uniform yellow. Later the live specimens became reddish brown, with markings more or less distinct. The bellies were white to cream, rather than yellow. Three specimens taken in Polillo in July, 1920,

were found in the unfolding leaves of *banban* plants, at a distance of about 2 meters from the ground; two were vivid greenish yellow above and white below, and the third was bluish green, later changing to yellow. The latter when placed in alcohol became bluish, and when fixed is a dark grayish blue. At first I believed I was dealing with a new species. More material may warrant a separation.

Basilan specimens were taken at night on October 10, 1920, in an old open well where they were breeding. Both males and females were dark brown with yellow or cream spots when taken. Masses of eggs were found around the edge of the well, and on plants about the walls. The eggs are laid in masses of foam, very similar to those of *Polypedates leucomystax*. They can be easily distinguished from that species by the fact that the mass is distinctly yellow, while that of *P. leucomystax* is whitish or cream. A number of larvæ and recently transformed young were taken some time later. One of the Polillo adult specimens has a curious deformity. The fourth toe sends off two branches at the antepenultimate joint, resulting in a total of seven fingers. The accessory fingers have developed distinct disks at the tips. The subarticular tubercle of the antepenultimate joint is at one side, wholly on the web.

*Polypedates linki* sp. nov. Plate 3, fig. 2.

*Type*.—No 1703, E. H. Taylor collection; collected at Jolo, Jolo Island, November 10, 1920, by E. H. Taylor.

*Description of type*.—(Adult female.) Choanæ large, not or but slightly concealed by overhanging jaw; vomerine teeth in two short slender oblique series arising from near the upper anterior edge of choanæ and not extending to posterior border; the series of teeth separated by a distance nearly equal to length of one series; tongue rather small, with two posterior horns, no tubercle; snout short, rather truncate; loreal region slightly oblique, concave; canthus rostralis distinct, the edge somewhat rounded; eyes moderate, diameter of orbit equal to distance from nostril; upper eyelid equal to or slightly wider than interorbital distance; distance between nostrils less than their distance from eye and less than interorbital distance; nostril very much nearer to end of snout than eye; tympanum large, entirely distinct, its diameter about two-thirds that of orbit; a well-developed straight glandular fold from behind eye running diagonally to a point some distance behind insertion of arm; interorbital area with a broad shallow depressed area; skin of back almost wholly smooth; skin on head smooth, not involved in cranial ossifica-



tion; edges of frontoparietal bones bordering orbit slightly raised, forming an indistinct narrow crest, converging rather strongly behind; a very faint suggestion of granulation evident on eyelid, on posterior part of body, and on femur; throat smooth or minutely granular; belly and inferior and posterior aspects of femur strongly granulate; three or four granules below anus very slightly larger than others; fingers with strongly dilated tips; subarticular tubercles strong; palmar and carpal tubercles dim, irregular; only small trace of web between fingers; a slight indistinct fold on outer side of arm; tips of toes dilated into disks only a little smaller than disks on fingers; toes webbed to disks on outer side of third and inner side of fifth; web reaches penultimate subarticular tubercle on fourth; first finger about half webbed; subarticular tubercles small, but well differentiated; a well-defined inner metatarsal tubercle; outer, if present, very dim and indistinguishable; a very dim fold on outer side of fifth toe to heel; sole with fine granulation; tibio-tarsal articulation reaches between eye and nostril.

*Color in life.*—Cream to lemon yellow above, with no traces of markings save a whitish area below eye in front of tympanum; underside cream. (Taken at night.) When preserved in formalin a few bars on the hind limb and a few dusky markings on the throat became visible; the body color became light gray to gray-brown.

*Measurements of Polypedates linki sp. nov.*

	No. 1703, type, ♀.	No. 1703A, ♂.
	mm.	mm.
Snout to vent .....	63	43
Length of head .....	23	17
Width of head .....	22	15
Snout .....	11	7.5
Diameter of eye .....	7	6
Upper eyelid .....	7	5.5
Interorbital space .....	6.5	5
Eye to nostril .....	7	5
Diameter of tympanum .....	5	3.8
Forelimb .....	39	29
Longest finger, with hand .....	19	14
Hind limb .....	100	72
Femur .....	35	22
Tibia .....	36	23
Longest toe, to metatarsal tubercle .....	23	18

*Variation.*—The type was collected while it was hopping in the streets of Jolo at night. Five specimens were taken in a small rain pool near the foot of Bud Daho, a low volcanic

crater 10 kilometers east of Jolo. These were sitting in the edge of the grass about the pool and immediately took refuge in the water. The five specimens are all males. (No females were seen in this locality.) These were gray white or cream yellow above. One specimen showed a triangular black mark in the interorbital region and a regular marking on the back. In formalin all show dim markings on limbs, and three have dim triangular markings on the head; there is only a faint suggestion of the white spot in front of the tympanum. No. 1704, taken a few kilometers south of Jolo, near Indanan, was found under the loosened bark of a tree. In life the specimen was brownish yellow, and the mark in front of the tympanum was strongly defined; there was a dim line along the upper lip with dim bronze markings on sides and throat. There is some variation in the relative size of the eye and the length of the snout. The males have no vocal sacs.

One of the specimens taken near Bud Daho was heavily infested with small yellow flukes, which were embedded in the muscles of the limbs and the head. More than fifty specimens of the fluke were taken; they measure, when preserved, 5 to 6 millimeters in length. Two more specimens of *Polypedates linki*, a young and an adult, were recently received from Jolo, collected by Capt. Francis Link.

The species is related to *Polypedates leucomystax* and *P. macrotis*, from which it differs in having a shorter hind limb and a narrower interorbital space, in color and markings, and in the fact that the skin on the head is not involved in the cranial ossification. It may also be related to *P. hecticus*, which is known from Samar, from which it differs in the absence of a strongly defined dorsolateral fold.

The type contains yellow eggs, 3 to 4 millimeters in diameter. The stomach contained a full-grown specimen of *Hemidactylus frenatus*.

*Remarks.*—The species is named for Capt. Francis Link, Philippine Constabulary, who accompanied me on numerous collecting trips about the island, and assisted greatly in making collections.

*Polypedates appendiculatus* (Günther).

*Rhacophorus appendiculatus* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 79.

*Polypedates appendiculatus* TAYLOR, Philip. Journ. Sci. 16 (1920) 280, Pl. 8, figs. 2, 2a, and 2b.

Specimens of this species of *Polypedates* were collected on Polillo Island and on Basilan Island. These two localities, particularly the former, extend the known range of the species greatly. Dinagat has hitherto been the most northern locality for the eastern Philippines. The species has been reported from Borneo, Mentawai Islands, and Celebes, outside of the Philippines. The occurrence of the species in the Calamian Islands has been reported by Boettger. I rather question this locality. It will be remembered that there was some doubt regarding the type locality of *Kalophrynus acutirostris* Boettger which is reported as being "entweder von Culion oder von Samar;" it is not improbable that the record for *Polypedates appendiculatus* should be Samar, since no other collector has obtained it either in the Calamian Islands or in Palawan.

The Polillo specimen (No. 877) was captured by myself on July 18, 2 kilometers east of the town of Polillo, in the half-opened leaf of a plant known locally as banban. When taken the specimen was pure canary to lemon yellow above and cream below; no markings of any sort were in evidence. When preserved it became very light lavender above with no markings. The skin is entirely smooth. The folds on the arm and foot are very distinct as are the folds below the anus.

On Basilan the specimens of this species were usually collected at night or during showers. They were for the most part marked or strongly colored. One specimen (No. 1368) taken at Port Holland had the following markings: Above gray, with regular distinct markings on head, shoulders, and back; pupil of eye deep blue, iris copper; throat and belly cream to yellow; anterior and posterior sides of hind limbs bright orange to vermilion. Another specimen (No. 1411) was dull olive brown above; chin greenish yellow; belly flesh-colored; anal region white; sides of femur vermilion.

The vermilion marking was evident in all of the Basilan specimens. The red markings of the femur persisted long after the specimens were preserved. Some show spots of black, but most of the specimens are dull mottled lavender when preserved. Some have granules or tubercles on the back; in others the skin is smooth. None of the specimens has extensive webbing on the foot as is shown in Boulenger's figure.<sup>4</sup>

Most of the specimens were discovered by hearing their call at night. All seem to be males.

<sup>4</sup> Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 86, pl. 8, fig. 4.

*Kalophrynus stellatus* Stejneger.

*Kalophrynus stellatus* STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 575; TAYLOR, Philip. Journ. Sci. 16 (1920) 329, pl. 9, fig. 2; Amphibians and Turtles of the Philippine Islands (1921) 130.

I obtained a splendid series of this species at Port Holland, Basilan, between October 8 and 14. The animals were found breeding in an old watering trough near the forest, and in pools of stagnant water held by gnarled tree roots in the same immediate locality.

A large female with a male clasped on her back was first discovered hopping toward the trough about 11 o'clock in the morning of October 8. I watched them enter the water and begin swimming about. The male kept holding on to the female with his arms, leaving his legs stretched out behind. After about five minutes the female ducked her head and anterior part of the body under the water, exposing the posterior part, and the anal opening. The male slid back until his head was out of the water, and clasping the female along the side of the belly placed his legs in such a position about the anus that a small cup was formed, into which the female extruded a small group of eggs, and the male, the sperm. Thus the eggs and sperm came into contact above the water. The female then righted herself, and the male pushed forward again. They swam a short distance, and the same process was repeated. This was done some twelve or thirteen times, an interval of one or two minutes elapsing between each extrusion.

The extruded eggs were surrounded by a gelatinous disk which encircled the sphere in a plane, and held the eggs from rotating; the disk has a circular depression between the egg and the outer rim. This disk gradually widens after extrusion until it becomes about 6 millimeters in diameter. From nine to seventeen eggs are extruded at one time. They could be counted floating together, each group separated from that preceding it. After completing the deposition, the female gave a slight kick and the male, apparently recognizing the signal, unclasped the female, and dived under the water. He reappeared a minute later, crawled over the edge of the tank, hopped to the ground, and started away. The female soon left the tank. Both were captured.

I watched more than ten pairs approach the tank, enter, and go through the same egg-laying process. All were captured after they left the tank.



The ground color on the back varied greatly. There were various shades of brown, red-brown, maroon, clay white, cream yellow, orange, lavender, and purple. Practically no two specimens could be found of exactly the same color. The characteristic markings on the back (two irregular lines crossing on the shoulders, continued brokenly across the folded leg, and large round black spots on the groins usually concealed by the femur when the animal is seated) were invariably present in life. Many, if not all of the males, had deep brown markings on the chin and the throat, and a few had the belly also spotted with dusky. Several specimens had a few scattered, irregular, deep black spots on the back. The stellate yellow dots on sides and belly are present in a large number of the specimens.

A single specimen, almost red above, was taken at Abung-abung, on the southern coast.

*Bufo philippinicus* Boulenger.

*Bufo philippinicus* BOULENGER, Ann. & Mag. Nat. Hist. V 19 (1887) 348, pl. 10, fig. 5; TAYLOR, Philip. Journ. Sci. 16 (1920) 344; Amphibians and Turtles of the Philippine Islands (1921) 145.

A splendid series of this species was recently obtained by Gregorio Lopez, at Coron, Busuanga. The series consists of numerous adult, half-grown, and young specimens.

Boulenger established the species on an adult female specimen collected in Palawan by Everett. The species has since been collected at various places in Palawan, Balabac, and Busuanga. Various reports of a large toad occurring in Mindanao have reached me, but I cannot state without doubt the origin of any of the specimens I have examined that are supposed to have come from Mindanao. No species of *Bufo*, as far as I know, has ever been reported authentically from Luzon or from the Visayan Islands. Three small species occur in Mindanao.

The largest specimen, an adult female, measures 92 millimeters from snout to vent. The largest male examined measures 73 millimeters.

The specimens at hand were collected in the daytime by schoolboys. More than twenty specimens were found.

*Megalophrys stejnegeri* Taylor.

*Megalophrys stejnegeri* TAYLOR, Philip. Journ. Sci. 16 (1920) 347, pl. 10, figs. 1 and 1a; Amphibians and Turtles of the Philippine Islands (1921) 148, pl. 10, figs. 1 and 1a.

Three specimens of this species were obtained; one from northern Surigao, collected and presented to me by Charles

Fuller Baker; one from Cabalian, southern Leyte, collected by Gregorio Lopez; the third from Zamboanga, Zamboanga, collected by me. The specimens agree with my figure and description.<sup>5</sup> The Leyte specimen is a male, with the openings of the vocal sacs distinct. The tuberculation on the sides of the three specimens is somewhat more pronounced than in the type. I find no trace of vomerine teeth in any of the specimens.

#### LIZARDS

##### *Lepidodactylus divergens* Taylor.

*Lepidodactylus divergens* TAYLOR, Philip. Journ. Sci. § D 13 (1918) 242; Lizards of the Philippine Islands (1922) 71.

Visits were made to Great Govenen and Little Govenen, two small islands directly in front of Port Holland, Basilan. Great Govenen, the type locality of this *Lepidodactylus*, was visited twice previously, but in the large series of specimens taken no male was found. The collections made there on October 9, 1920, contained fourteen specimens from the larger island, and twenty-three from the smaller one. One male was found in the first lot; two in the second. The number of preanal pores agrees very well with counts recorded for the preanal scales in the females.<sup>6</sup>

##### *Preanal pores in males of Lepidodactylus divergens* Taylor.

No.	Locality.	Preanal pores.
1300....	Great Govenen .....	15-15
1236....	Little Govenen .....	16-18
1284A ..	do .....	15-16

The species could not be found along the Basilan coast although great effort was made to find it. No specimen of *Lepidodactylus woodfordi* was found on the islands on this visit. One specimen was found during a previous visit.

##### *Lepidodactylus aureolineatus* Taylor.

*Lepidodactylus aureolineatus* TAYLOR, Philip. Journ. Sci. § D 10 (1915) 97; Lizards of the Philippine Islands (1922) 83.

I collected a single specimen of this species at Abung-abung in southern Basilan. It is an adult male and agrees very well with the type. There are nineteen preanal-femoral pores on each side, which is the exact count in the type; thirteen or fourteen

<sup>5</sup> Loc. cit.

<sup>6</sup> Taylor loc. cit.

upper labials, twelve lower. The last three upper labials are very small and indistinct.

The specimen was collected under loose bark on a large forest tree. No other specimen was seen. When first collected the color above was dark olive, the belly yellow. A bright golden, black-edged line, extending from the eye to above the auricular opening, is dimly evident in the loreal region. No marking was discernible on the back. The tail is colored like the body, with a few indistinct darker marks.

*Sphenomorphus luzonensis* (Boulenger).

*Lygosoma luzonense* BOULENGER, Proc. Zool. Soc. London (1894) 733, pl. 49, fig. 2; TAYLOR, Lizards of the Philippine Islands (1922) 175, pl. 15, fig. 1.

A good series of this small *Sphenomorphus* was collected along the small brooks in the neighborhood of Balaban, Kalinga.

The specimens were always found in the immediate vicinity of water, and when disturbed they would take refuge by diving in the water and concealing themselves under rocks or débris at the bottom. Several of the specimens are females containing partially developed eggs.

*Color in life*.—No. 734, the largest specimen taken (101 millimeters), is brown above; median line deep chocolate with ill-defined bluish white spots; a broad chocolate lateral stripe, edged above and below with rows of black and bluish white, ill-defined spots; sides, below the chocolate stripe, salmon to orange with white flecks; backward from the arms the breast and belly are deep orange, more pronounced posteriorly; basal part of tail deep orange, verging into flesh color toward tip. Chin, flesh color to white, flecked with darker. Most of the specimens have the same color and marking. The orange on the belly is usually well pronounced in adults.

*Sphenomorphus beyeri* sp. nov.

*Type*.—No. 17, E. H. Taylor collection; collected May 31, 1920, on Mount Banahao, Laguna Province, Luzon, elevation about 1,500 meters, by E. H. Taylor.

*Description of type*.—Rostral large, clearly visible above, forming a strongly curved suture with the frontonasal; latter wider than long, very narrow laterally, touching first superior loreal, forming a short curved suture with the frontal; prefrontals moderately large, separated, touching two superior loreals, first superciliary, and first supraocular; frontal generally triangular, much longer than wide, very strongly narrowed behind to a point, leaving interorbital region extremely narrow; frontoparie-



tal single, slightly longer and larger than frontal, broader than long; interparietal small, considerably longer than wide; parietals forming a suture behind interparietal; nasal large, single, the nostril pierced near center; nasal followed by two pairs of superimposed loreals, the two upper larger than the lower; three large superimposed preoculars, the median most anterior; orbit separated from labials by two or three rows of small scales, the two above the fourth labial rather enlarged; ten superciliaries, the anterior very large, comparatively; four supraoculars, the anterior triangular, the second widest; last supraocular followed by four curved rows of very small scales, each row with three scales, separating orbit from the very large superior temporal; seven upper labials; four elongate superior temporals lying posterior to one another, the one touching parietal largest; lower temporals small, irregular, numerous; six or seven lower labials; mental moderate, extending back to middle of first upper labial; a very large azygous postmental, followed by two pairs of chin shields, the second small, widely separated; ear opening large, oval, the tympanum not deeply sunk; no anterior lobules; scales in forty rows around the body, the rows on sides regularly longitudinal; two strongly enlarged preanal scales; limbs moderate, the adpressed hind limb reaches to near elbow of the adpressed forelimb; eleven lamellæ under longest finger; seventeen under longest toe.

*Color in life.*—Head purplish to lavender; body generally lavender-brown, mottled with darker brown; a median indistinct series of blackish spots; lateral, irregular, dark brown lines with light yellow-brown, rounded markings above and below; above the arm and on the neck the lateral dark mark widens, takes a downward course, and is very distinct; the yellow-brown markings below are very distinct; labials purplish, each with a rounded light spot; chin, throat, and sides of neck flesh color, mottled and reticulated with lavender; belly yellow to flesh color; underside of arm yellow; posterior part of femur with round yellow spots and a dark mark on outer side of leg; dark markings above insertion of legs very distinct; tail missing.

*Measurements of the type of Sphenomorphus beyeri sp. nov.*

	mm.
Total length	46
Snout to vent	42
Width of head	6.5
Length of head	11
Forelimb	12
Hind limb	17
Width of body	7



*Remarks.*—The specimen was captured on a ledge, on Mount Banahao. The tail was inadvertently broken, and it wriggled off the ledge to an inaccessible point below. The species, judging by the superimposed loreals, is related to *Sphenomorphus curtirostris* Taylor. It differs in the arrangement of the scales in front of and below the eye, and in the nature of the temporals. The colors and markings are different, and several other differences are evident. The new species is represented by the type only, and it is probably very rare. The species is named for Dr. H. Otley Beyer, associate professor of ethnology and anthropology of the University of the Philippines, who has assisted me in making collections.

*Tropidophorus stejnegeri* sp. nov. Plate 4, fig. 1.

*Type.*—No. 1538, E. H. Taylor collection; collected at Abung-abung, Basilan, October 22, 1920, by E. H. Taylor.

*Description of type.*—Rostral nearly perpendicular, not bent back over snout, wider than high, lowest medially; frontonasal much broader than long, touching one loreal laterally; prefrontals much smaller than frontonasal, in contact medially, touching both loreals, and in contact with first supraocular; frontal extending anteriorly to edge of orbit, posteriorly to middle of eye, in contact with three supraoculars; four supraoculars, the third as wide as or wider than second; last supraocular followed by a single small scale; frontoparietals small, forming a suture much more than half their length; interparietal two and one-half times as long as broad; parietals separated, nearly as broad as long, very irregularly shaped, bordered posteriorly by an elongate temporal which is separated from its fellow by four small scales; nostril in single nasal; two loreals, second nearly double the size of first, separated from labials by a narrow intercalated scale, followed by three pre- or suboculars; seven superciliaries; eight upper labials, the first four small, subequal, followed by the fifth which is greatly enlarged; sixth smaller than fifth but larger than seventh; eighth smaller still; a strong diagonal groove in front of eye and another, less pronounced, above anterior labials; temporals numerous, irregular, those above seventh labial rather elongate; eye moderate, the diameter of orbit equaling distance to end of snout; snout short, the outline of head above in profile a strong, rather regular curve; tympanum large, not deeply sunk, much higher than wide, its distance from orbit little greater than orbit or length of snout; five lower labials, the three anterior elongate, the last two very much smaller, mental very slightly wider than rostral, not as

deep; a large azygous postmental; latter followed by three pairs of chin shields, the two anterior in contact medially, the second pair much larger than the first pair, third pair separated by three scales; scales on back strongly keeled, the keels forming longitudinal lines on the six median rows; lateral keels form irregular diagonal lines; scales on belly not keeled; a single large preanal; tail with scales strongly keeled above; median scale row under tail somewhat widened and not keeled; limbs well developed, the adpressed hind limb reaching the elbow of the adpressed forelimb; seventeen lamellæ under fourth finger, twenty-six or twenty-seven under longest toe; tip of tail regenerated.

*Color in life*.—Above brown, the body traversed by seven broad, brick-red, irregular blotches, separated by a distance less than their width; sides variegated brown with scattered dots of cream yellow; belly yellow; indistinct spots on throat greenish white; a few yellow dots on labials and temporals; a deep brown spot back of eyes; base of tail below yellow; remaining part mottled gray and yellow; tympanum yellowish.

*Measurements of the type of Tropidophorus stejnegeri sp. nov.*

	mm.
Total length	185
Snout to vent	93
Tail (partly regenerated)	92
Axilla to groin	48
Forelimb	28
Snout to forelimb	32
Hind limb	41
Orbit to end of snout	6.5
Tympanum to end of snout	18
Width of head, at posterior edge of orbit	13
Greatest width of head	15
Length of head	20

*Variation*.—There are nine cotypes in the collection, and they differ but little from the type. In two specimens from Zamboanga there are but two supraoculars in contact with the frontal; the Zamboanga specimens have the bars on the back orange and narrower than the interspace separating them; there are twenty-three and twenty-one lamellæ under the toes of the two specimens. Only one specimen, an adult male, from Basilan (No. 1529), has the chin and throat rather purplish (in all others the throat is light with dusky powdering). The belly is yellow. In this specimen the bars on the back are narrow and less prominent than in the type.

*Remarks*.—This species was found on the Zamboanga Peninsula and in southern Basilan. In both localities *Tropidophorus*

*rivularis* Taylor was also taken. The two forms are undoubtedly closely related, and many of the actual differences can scarcely be described. The differences in color are strongly marked, particularly the orange or red bars on the back, and the yellow belly. *Tropidophorus rivularis* is usually mottled gray and brown above with indistinct darker bands, the belly red-orange, the throat deep black. The width of the head is greater in this new species as are also the width of the chin shields and the distance between the angle of the jaws; the count of lamellæ under the longest toe is greater. There are only four instead of five labials in front of the large subocular labial. *Tropidophorus rivularis* was never found save along streams and brooks; on the other hand, *T. stejnegeri* was found on spurs of mountains in dry situations, never near water.

Stejneger has described *Tropidophorus misaminius* from northern Mindanao. It is, however, more closely related to *T. rivularis*, since it has the five labials preceding the subocular labials. He states that the keeled scales form eight straight longitudinal rows in his species; in *T. stejnegeri* there are but six.

The species is named for Dr. Leonhard Stejneger, the eminent herpetologist of the United States National Museum, Washington, D. C.

***Brachymeles gracilis* (Fischer).**

*Eumeces (Riopa) gracilis* FISCHER, Jahrb. wiss. Anst. Hamburg (1885) 11, 85, pl. 3, fig. 1.

*Brachymeles suluensis* TAYLOR, Philip. Journ. Sci. § D 13 (1918) 254.

*Brachymeles gracilis* TAYLOR, Lizards of the Philippine Islands (1922) 245, 246.

At the time I was preparing my paper on the genus *Brachymeles*<sup>7</sup> I did not have at hand Fischer's original description, but depended on Boulenger's Catalogue<sup>8</sup> for my identifications. I have since obtained a photographic copy of Fischer's paper and find that the species I described as *Brachymeles suluensis* is *B. gracilis* (Fischer) but not *B. gracilis* Boulenger, an entirely different species, which I have named *B. boulengeri*.

*Brachymeles gracilis* (Fischer) is characterized by the small head, elongate body, and the great distance between the limbs, which are much reduced. The similarity between the head scales of this and those of various other species of the genus is very striking.

<sup>7</sup> Philip. Journ. Sci. § D 12 (1917) 267-279.

<sup>8</sup> Cat. Liz. Brit. Mus. 3 (1887) 386-388.



Fischer's figure of the type of *Brachymeles gracilis* is drawn  $\times 4$ , while that of *B. schadenbergi* is  $\times 2$ —a point which I at first overlooked; I suspect others have done likewise. In the descriptions, Fischer fails to give head measurements for either species. There are specimens in my collection of both *B. schadenbergi* and *B. boulengeri* whose head scales are identical with those as shown in Fischer's drawing of *B. gracilis*; there are young specimens of *B. boulengeri* which approach the measurements given for *B. gracilis* (Fischer), but the limbs are invariably longer in specimens of equal snout-to-vent measurements, and are contained in the axilla-to-groin distance a fewer number of times than is the case in *B. gracilis* (Fischer).

Three specimens of this rare species were found on Basilan; two near Isabela, in the western part, and one at Abung-abung, on the southern coast. The type specimen of *B. suluensis* came from Bubuan, an island a short distance southwest of Basilan. There are two or three specimens of *Brachymeles* in the United States National Museum that I believe belong to this species. They were taken in Cotabato Province, Mindanao. I am indebted to Dr. Leonhard Stejneger for permission to examine these specimens. It was Doctor Stejneger who first suggested to me that *B. gracilis* (Fischer) and *B. suluensis* Taylor might be identical.

*Measurements of Brachymeles gracilis* (Fischer).

	No. 1172.	No. 1173.	No. 1520.	Type of <i>B. gra- cilis</i> .	Type of <i>B. sulu- ensis</i> .
	mm.	mm.	mm.	mm.	mm.
Total length .....	93	<sup>a</sup> 111	132	-----	117
Snout to vent .....	49	71	66	67	81
Snout to forelimb .....	15	17.5	18	18	19
Axilla to groin .....	31	50.5	46	45	55
Width of head .....	6	7.5	7	?	7
Forelimb .....	5.5	6	6	6	6
Hind limb .....	8	11	11.5	12	<sup>b</sup> 11-13

<sup>a</sup> Tip of tail regenerated.

<sup>b</sup> The type has one hind limb measuring 11 millimeters, the other 13 millimeters.

*Remarks.*—No. 1172 agrees with the type in the scalation of the head. However, it has twenty-six instead of twenty-four scale rows around the body. The length of the leg is contained in axilla-to-groin distance approximately four times.

No. 1173 agrees with the type in scalation, save that the frontal and frontonasal are more broadly in contact. The post-parietal body scales on the left side are fused, forming an



elongate nuchal. The length of the leg is contained in the axilla-to-groin distance four and six-tenths times. Scales in twenty-four rows around body.

No. 1520, collected at Abung-abung, differs from the type in having the parietal broken into two scales, as have certain specimens of *Brachymeles vermis* Taylor and *Sphenomorphus biparietalis* Taylor, both from the Sulu region. The first pair of chin shields is separated by a small single shield. Scales in twenty-four rows around body.

This species probably does not attain as large a size as the other pentadactyl species of the genus. It is a burrowing form and is usually found under logs or stones. The lizards of this species move with great rapidity. It is difficult to grasp them because of their extremely smooth scales.

***Brachymeles schadenbergi* (Fischer).**

*Eumeces (Riopa) schadenbergi* FISCHER, Jahrb. wiss. Anst. Hamburg 2 (1885) 87, pl. 3, fig. 2.

*Brachymeles schadenbergi* TAYLOR, Philip. Journ. Sci. § D 12 (1917) 268; Lizards of the Philippine Islands (1922) 249.

Twenty-one specimens of this species were taken at Zamboanga, Basilan, and Jolo. They agree very well in color and markings. A single specimen was collected in southern Leyte, by Gregorio Lopez.

The head scales are variable. Thus, of the twenty-two specimens, twenty-one have the supranasals in contact and one has them separated. In seventeen specimens the parietals form no suture; in five specimens they do. Seven specimens have the fourth labial entering the orbit; fifteen, the fourth and fifth. The character of the chin shields is apparently invariable, save in one Jolo specimen, which has the second pair wider than the first pair.

***Brachymeles vermis* Taylor.**

*Brachymeles vermis* TAYLOR, Philip. Journ. Sci. § D 13 (1918) 255, fig. 10; Lizards of the Philippine Islands (1922) 258, fig. 53.

Eight specimens of this small wormlike form were collected on the Government cattle ranch near the central part of Jolo Island. They were found under leaves and trash along a small stream.

All the specimens agree in the arrangement of the chin shields; that is, having the first pair separated and the second pair wider than the first pair, separated by a single scale. All have the postmental in contact with a single labial.

In the conformation of the head scales they agree in general

with the type. The nasals are broadly separated in the eight specimens; the prefrontals are separated in seven, in contact in one; the frontoparietals are separated in the eight specimens, the parietals separated in seven, and forming a suture in one. Small nuchals are present in all the specimens. In a single specimen, the parietals are broken as shown in the drawing of a cotype.<sup>9</sup>

*Dibamus argenteus* Taylor. Plate 4, fig. 2.

*Dibamus argenteus* TAYLOR, Philip. Journ. Sci. § D 10 (1915) 107, pl. 1, figs. 11 and 12; Lizards of the Philippine Islands (1922) 261.

Several specimens belonging to this species were collected on Basilan at Port Holland. Specimens were found under rotting logs in a cut-over area. All of the specimens show the irregular silver blotches on the body. I have already reported, in my work on the lizards of the Philippine Islands, the Negros and Papahag specimens that are listed in the table.

*Measurements and scale counts of Dibamus argenteus Taylor.*

No.	Locality.	Collector.	Sex.	Length	Tail.	Scale rows.	Upper labials.	Scales bordering interparietal.	Length of leg.
				mm.	mm.				mm.
1216	Port Holland, Basilan.	E. H. Taylor	♀	132	19.5	22	1	5	
1219	do	do	♀	126	18.5	22	1	6	
1220	do	do	♂	88	13.0	22	1	6	2
1221	do	do	♂	123	19.0	22	1	6	3.6
1258	do	do	♂	122	19.5	22	1	5	4.0
L341	Negros	do	♀	154	23.0	22	1	7	
L257	Papahag Island, Sulu.	do	♂	120	(?)	22	1	7	3.5

The limbs of this species appear to be larger and better developed than in *Dibamus novae-guineae* Duméril and Bibron. In Boulenger's illustration the limbs appear to be covered<sup>10</sup> with one large terminal scale and a single pair of scales above or, at most, three scales. In my specimens the limb has a large, rather pointed, terminal scale with three or four pairs of smaller scales; the preanals, too, are different, consisting of two elongate scales separated by two or three scales, the tips of these overlying a sharply pointed scale which lies directly on the edge of the anus. In the females the arrangement of the preanals is

<sup>9</sup> Taylor, loc cit., fig. 10d.

<sup>10</sup> Fauna Malay Peninsula, Rept. & Batr. (1912) figs. 26 A and B.

also different. The tail length of this species is contained in the body length an average of six and six-tenths times.

## SNAKES

*Natrix barbouri* sp. nov.

*Tropidonotus crebripunctatus* BOULENGER (non Wiegmann), Cat. Snakes Brit. Mus. 1 (1893) 262.

*Natrix crebripunctata* TAYLOR, Snakes of the Philippine Islands (1922) 91.

*Type*.—No. 939, E. H. Taylor collection; collected at Balbalan, Kalinga, Luzon, April 26, 1920, by E. H. Taylor.

*Description of type*.—(Adult male.) Rostral much broader than high, slightly visible above; internasals longer than broad, longer than prefrontals; latter broader than long, much broader than internasal; frontal bell-shaped, the anterior edge nearly a straight transverse line; length of frontal equal to or slightly less than supraocular, slightly longer than its distance from end of snout; supraoculars elongate, slender, at least two and one-half times as long as broad; parietals only very slightly longer than frontal, the width equal to three-fourths the length; nasal divided, anterior part lower and longer than posterior part; loreal nearly square, much lower than nasal; two preoculars, the upper broader than the lower (three on right side); eye large, its diameter equal to its distance from anterior edge of anterior nasal scale; four postoculars; two anterior temporals, the lower much the larger, touching two postoculars; three equal-sized posterior temporals; nine upper labials, the fourth, fifth, and sixth entering orbit; ten lower labials, five touching anterior chin shields; mental broadly triangular, much wider than deep, not as wide as rostral; anterior chin shields forming a suture their entire length, not three-fourths as long as second pair, which are separated their entire length; scales in 19 rows, all strongly keeled, with apical pits; ventrals, 169; anal, divided; subcaudals, 107; tail long, slender, ending in a sharp point.

*Color in life*.—Gray above with transverse indistinct bands of black, broken laterally by yellowish spots; head olive without markings; neck dark without a yellow spot; upper labials yellow, edged with black above and a small spot on each of the first three labials; lower labials, chin, and throat white; a row of black dots on outer edge of ventrals strongly defined to tip of tail; outer edges of ventrals marked with gray on anterior part of belly; on latter half the entire belly also gray; under tail gray with edges of subcaudals yellowish.

Measurements of the type and the cotype of *Natrix barbouri* sp. nov.

	Type, ♂.	Cotype, ♀, No. 836.
	mm.	mm.
Total length.....	803	820
Snout to event .....	553	560
Tail.....	250	260
Width of head.....	11.5	13
Length of head.....	20	20
Diameter of eye.....	6	6
Eye to end of snout.....	6.4	6.3

*Remarks.*—In a previous publication <sup>11</sup> I stated in a footnote: "I strongly suspect that *N. crebripunctata* Wiegmann is indeed *N. spilogaster*. I believe further that Boulenger's species of this name is a distinct species." After obtaining a copy of Wiegmann's type description, and comparing it with young and half-grown specimens of *Natrix spilogaster* (Boie) from Manila, and after obtaining specimens of a *Natrix* which is undoubtedly Boulenger's *Tropidonotus crebripunctatus* and comparing these with Wiegmann's type description, I have no hesitancy in placing *Tropidonotus crebripunctatus* of Wiegmann as a synonym of *Natrix spilogaster* (Boie) and making a new species of the *Natrix* I have found, and which appears to be the same as that which Boulenger calls *T. crebripunctatus*.

*Variation.*—There are only two specimens in my collection and a very young one in the collection of the College of Agriculture at Los Baños that I believe belong to this species.

The cotype is likewise from Balbalan, Kalinga. It differs somewhat in scale counts from the type, as follows: Ventrals, 163; subcaudals (tip of tail missing), 95; preoculars, 3; postoculars, 2 on right, 3 on left side. In other respects the specimen agrees with the type in scalation.

The scale counts for the College of Agriculture specimen are: Ventrals, 160; subcaudals, 100; preoculars, 2; postoculars, 3; temporals, 2+2 and 2+3. It likewise agrees with the type save that the head is proportionately larger, as is natural in very young specimens.

In color the cotype differs from the type in having a very narrow yellow line on the median dorsal surface, broken by narrow black spots less than half the length of the intervening yellow. This continues some distance on the anterior part of the body. The entire latter half of the belly is gray, as well as

<sup>11</sup> Snakes of the Philippine Islands (1922) 92.



the subcaudal area. This vertebral stripe is mentioned in Boulenger's description<sup>12</sup> as being present.

In comparing these specimens with Wiegmann's description I find that none of the three specimens has the white nuchal spot ("der Nacken dunkler mit einem weissen Fleck"), which is invariably present in *Natrix spilogaster*; the two small spots on the parietal scales are wanting ("die beiden Punkte der Occipitalschilder, die auch bei andern Kielnatter-Arten in Jugendalter vollkommen"), and there is only a single irregular row of black dots on the outer edge of the ventrals instead of innumerable black dots arranged in transverse rows as is true in *Natrix spilogaster*. ("Die Bauchseite ebenfalls weisslich, aber mit unzähligen schwarzen Punkten bedeckt, die auf den einzelnen Bauchschildern in Querreihen zu 6-10 stehen".) The ventral and subcaudal counts of Wiegmann's specimen (148 and 96) are well within the range for *N. spilogaster*, but much lower than in the species described, in which they are 163 to 169 for ventrals and 100 to 107 for subcaudals.

The species is named for Dr. Thomas Barbour, the eminent herpetologist of the Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass.

*Natrix lineata* (Peters).

*Tropidonotus lineatus* PETERS, Mon. Berl. Ak. (1861) 686.

*Natrix lineata* TAYLOR, Snakes of the Philippine Islands (1922) 92.

I collected three specimens of this snake along Tumugao River, Zamboanga, Mindanao, and seven specimens on Basilan, at Port Holland and Abung-abung. In general they differ from specimens collected in Agusan, Mindanao, in color and markings. Most of the Agusan specimens are dull black above with no markings distinguishable save in very young specimens. In all ten specimens the color is light olive above, with a regular network of black markings and an indistinct series of yellowish dots on the sides. The ventrals and subcaudals have a large dusky area near the middle. The head is deep brown. The strongly defined yellow labial line is present in all the specimens. All of them show a dark nuchal band with a light, irregular, nuchal spot.

No. 1403, the largest specimen collected, was found at night near an old unused well where *Polypedates pardalis* were breeding. In life the colors were as follows: Top of head and anterior part of body reddish brown, gradually becoming olive on the

<sup>12</sup> Loc. cit.

posterior part of body and tail; line on lip brownish white; chin and throat white; neck spot white; belly with dirty olive markings; outer edges of ventrals pinkish. Most of the specimens were taken under rocks along small rivers. The known ventral range of the species is 132 to 142; the subcaudal, 61 to 73.

*Measurements and scale counts of Natrix lineata (Peters).*

No.	Locality.	Collector.	Age or sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Preoculars.	Postoculars.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Temporal.
1015	Zambo- anga.	E. H. Tay- lor.	♂	mm. 463	mm. 120	139	73	2	2	3	8	10	3, 4, 5	5	1+3
1046	do	do	♂	412	107	136	68	2	2	3	8	10	3, 4, 5	5	1+3
1016	do	do	♂	305	73	137	68	2	2	3	8	10	3, 4, 5; 4, 5	5	1+3
1403	Port Hol- land, Basilan.	do	♀	598	140	132	61	2	1-2	3	8	9-10	3, 4, 5	4-5	1+3
1480	Abung- abung, Basilan.	do	yg	266	62	134	64	2	2	3	8	10	3, 4, 5	4-5	1+3
1481	do	do	♀	430	105	136	64	2	1	3	8	10	4, 5	5	1+3
1590A	do	do	♂	550	140	133	68	2	2	3	8	10	3, 4, 5; 4, 5	5	1+3
1590B	do	do	yg	260	57	133	62	2	1-2	3	8	10	3, 4, 5	5	1+3
1590C	do	do	yg	253	60	132	67	2	3-2	3	8	10	3, 4, 5	5	1+3
1590D	do	do	♀	463	120	132	69	2	2	3	8	10	3, 4, 5	5	1+3

*Natrix dendrophiops (Günther).*

*Tropidonotus dendrophiops* GÜNTHER, Ann. & Mag. Nat. Hist. V 11 (1883) 136, fig.

*Natrix dendrophiops dendrophiops* TAYLOR, Snakes of the Philippine Islands (1922) 95.

One specimen of this rare species was collected at Port Holland, Basilan. Its presence was discovered by hearing the cry of a frog which it had just caught and was beginning to eat. It was the only specimen seen. *Natrix lineata* (Peters) and *Natrix auriculata* (Günther) were taken in the same locality.

*Color in life.*—Head and anterior fifth of body olive to olive brown, gradually more brownish on the second fifth; latter three-fifths of body olive to dull olive brown. On the second fifth distinctly maroon to red-brown on sides, more pronounced

on the edges of the ventrals; the yellow spots in the black cross-bands are strongly pronounced, continuing some distance on the tail, less distinct on the neck. No spots on the parietals and no nuchal spot; black marks on lower labials at the sutures; spots on the first three upper labials and on the sixth.

*Scalation*.—Nine upper labials, ten lower labials; one pre-ocular on left, two on right; three postoculars; temporals two, followed by three, the lower anterior very large; scales in seventeen rows; tip of tail missing; anal, double; ventrals, 168. This is the first record of the snake from Basilan.

This species differs from *Natrix barbouri* sp. nov. in the larger eye and the dentition.

*Oxyrhabdium modestum* (Duméril and Bibron).

*Stenognathus modestus* DUMÉRIL and BIBRON, Erp. Gén. 7 (1854) 504.

*Oxyrhabdium modestum* TAYLOR, Snakes of the Philippine Islands (1922) 100.

I collected three specimens of this snake in 1920; two near Zamboanga, and one on Basilan Island. Gregorio Lopez collected a specimen at Cabalian, Leyte. The specimens from Zamboanga and Basilan have rather shorter, wider heads than the Leyte specimen has, and a higher average of ventrals, the counts for the two Zamboanga specimens being much higher than any recorded counts. The known range is: Ventrals, 162 to 189; subcaudals, 49 to 66. The chin shields of the Leyte specimen are longer and narrower than those of the other specimens. The Zamboanga specimens were found in a rotted tree stump. The Basilan specimen collected at Abung-abung was found at the base of a small palm tree.

*Measurements and scale counts of Oxyrhabdium modestum* (Duméril and Bibron).

No.	Locality.	Collector.	Sex.	Length. mm.	Tail. mm.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Postoculars.
1017	Zamboanga.	E.H. Taylor.	♀	445	75	189	62	8	7	5-6	5	2
1047	do	do	♀	482	80	186	57	7	7-6	4-5	4-5	2
1593	Basilan.	do	♀	340	62	174	58	8	6	5-6	4	2
0000	Leyte.	Gregorio Lopez.	♂	500	98	165	57	9-8	7	5:6:7 5:6		

*Oxyrhabdium leporinum* (Günther).

*Rhabdosoma leporinum* part., GÜNTHER, Cat. Col. Snakes Brit. Mus. (1858) 12.

*Oxyrhabdium leporinum* TAYLOR, Snakes of the Philippine Islands (1922) 103.

Three specimens are in the collection, one collected by myself along the mountain trail near Haight's (Pauai); the other two were collected by Father F. Sanchez, S. J., at Baguio, and presented to me. No. 697 when taken was light olive to yellow-green above, dusky below. This specimen differs from the other two in having the chin shields together, forming a circle. The shields are shorter and wider than normal. No. 384 is a young specimen with a broad light area behind the eye which narrows above and crosses the occiput on the posterior edges of the parietals. The body is crossed by thirty-seven narrow yellow lines not wider than a single scale.

*Measurements and scale counts of Oxyrhabdium leporinum* (Günther).

No.	Locality.	Collector.	Age or sex.	Length.	Tail.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Scale rows.	Temporals.
				mm.	mm.								
697	Mountain trail, Benguet.	E. H. Taylor	♂	640	92	175	42	7	6	4, 5	4	15	1+2
547	Baguio, Benguet.	Father Sanchez.	♀	540	90	169	49	7	6	4, 5	4	15	2+2 1+2
384	do	do	yg	235	36	167	45	7	6	4, 5	4	15	1+2

*Zaocys luzonensis* Günther.

*Zaocys luzonensis* GÜNTHER, Proc. Zool. Soc. London (1873) 169; TAYLOR, Snakes of the Philippine Islands (1922) 135, pl. 12, figs. 1 and 3; pl. 13, figs. 1 and 2.

Three specimens of this rare snake were obtained; one in northern Kalinga at Balbalan, one in Polillo Island, and the third was presented to me by Mr. O. W. Pflueger of the School of Forestry at Los Baños. The Polillo specimen is very young and differs so markedly in coloration that I suspected when I collected the specimen that it was new.

*Variation.*—The Kalinga specimen is brown above on the anterior part of the body, each scale with a black area or edged with black. The middle third of the body is lighter



brown, the scales more deeply edged with black; in fact, the black is predominant. The latter third has the black still more prominent, with groups of flowerlike yellow-brown spots on each side of the median line of the back. The tail is entirely black save on the basal third, which has a few spots arranged in two rows on the dorsal surface. Chin and anterior third

*Measurements and scale counts of Zaocys luzonensis* Günther.

No.	Locality.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Upper labials.	Lower labials.	Labials touch chin shields.	Preoculars.	Postoculars.	Temporals.	Scale rows.
811	Kalinga	♂	mm. 1,640	mm. 480	192	122	2	9-8 8	9	5	1-2	3	2+2 2+2+1 1	14
295	Polillo		508	138	202	124	2	8	9	5	2	2	2+2	14
000	Los Baños		2,060	580	201	126	2	8	8-9	5	3-2	2	2+2	14

of belly flesh color; median third flesh color anteriorly, each ventral edged with black and growing heavier posteriorly; posterior third of belly and under tail deep black. The snout is light brown; the top of the head black-brown with no markings on labials.

The specimen from Los Baños differs in having much less black on the posterior part of the body. The yellow-brown spots continue to near the tip of the tail. The young Polillo specimen is gray, reticulated with black. On the anterior part of the body there are some dim white bars. The anterior part of the belly is flesh-colored; the posterior part and underside of tail black.

*Holarchus meyerinkii* (Steindachner).

*Holarchus meyerinkii* TAYLOR, Snakes of the Philippine Islands (1922) 139.

I found a single young specimen of this species near Indanan, Jolo. I unearthed it from under débris collected about the base of a large tree. When exposed it crawled very slowly.

*Description.*—(No. 1710.) The specimen agrees with that figured in my Snakes of the Philippine Islands in the scalation of the head, save that the nasal is entirely divided instead of only partially. The scale counts are: Ventrals, 157; anal, single;

subcaudals, 46. There are eight lower labials on the left side and seven on the right. Four lower labials touch the first pair of chin shields on the right side, and five on the left. Total length, 160 millimeters; tail, 27.

*Color in life.*—Above striped, dull salmon pink and brown; a pair of broad, dark brown stripes, each covering two whole and two half rows of scales, separated by a salmon pink, straight-edged, median stripe, covering one whole and two half rows of scales; the inner edge of the brown stripes on either side is deep black, and the outer edge with numerous black dots; below the broad stripes laterally is a flesh-colored stripe covering two half scale rows; below this another brown, black-edged stripe, also covering two half rows of scales; below this another dull flesh-colored line covering parts of two scale rows, below which is another line, nearly black, covering parts of two scale rows; another flesh pink line follows, covering part of the outer scale row and the edges of the ventral, the ventrals with elongate spots on each side forming a narrow black line; belly flesh color to coral pink; a curved, rather broad line crossing head involving eyes; the median brown lines meet on the frontal; a line across the angle of mouth; deep black spots on the anterior ventrals.

*Remarks.*—The specimens whose scale counts are available give the following variation: 156 to 162 for the ventrals, average 158; subcaudals, 43 to 48, average 45. It will be noted that this form differs from *Holarchus octolineatus* (Schneider) not only in the lower ventral count but also in a very much lower subcaudal count.

***Psammodynastes pulverulentus* (Boie).**

*Psammophis pulverulenta* BOIE, Isis (1827) 547.

*Psammodynastes pulverulentus* TAYLOR, Snakes of the Philippine Islands (1922) 209.

Fifteen specimens were collected in Zamboanga, Basilan, and Jolo. I failed to find it in the other localities in which I made collections. This widely distributed species varies greatly in color, but in the material examined I cannot separate any varieties. The table shows the average ventral counts for five Basilan specimens as 170; the average for three Jolo specimens as 152; for the seven specimens from Zamboanga, 163. There is less variation in the subcaudal counts. The known range for ventral and subcaudal counts is 151 to 179, and 53 to 69, respectively. Females are darker for the most part than males.

Table of measurements and scale counts of *Psammodynastes pulverulentus* (Boie).

No.	Locality.	Collector.	Sex or age.	Length. mm.	Tail. mm.	Ventrals.	Subcaudals.	Preoculars.	Postoculars.	Loreals.	Upper labials.	Lower labials.
1018	Zamboanga.	E. H. Taylor.	♂	315	58	163	58	2-3	2	2	8	7
1080	do	do	yg	290	61	160	62	2	2	1	8	7
1102	do	do	♂	354	75	156	65	2	2	2	8	7
1111	do	do	♀	405	73	168	59	2	2	2	8	7
1112	do	do	♂	395	64	161	<sup>a</sup> 44	2	2	1	8	7
1113	do	do	♀	493	90	165	59	2	2	2	8	7
1114	do	do	♀	490	89	167	63	2	2	2	8	7
1482	Basilan	do	♀	445	80	170	55	2	3	2	8	7
1556	do	do	yg	184	34	170	61	2	2	2	8	7
1588	do	do	yg	181	31	179	55	3	2	2	8	7
1591	do	do	♂	345	58	174	55	1	2	1	8	7
1591A	do	do	yg	275	55	160	63	1	2	1	8	7
1722	Jolo	do	yg	365	78	146	59	2	2	2	8	7
1723	do	do	♀	376	67	156	57	2	3	2	8	7
1862	do	do	♀	395	78	154	57	2	3	2	8	7

<sup>a</sup> Tip of tail missing.***Boiga dendrophila divergens* Taylor.***Boiga dendrophila divergens* TAYLOR, Snakes of the Philippine Islands (1922) 201.

Two specimens of this recently described form have been taken; one (No. 301) in Polillo, the other (No. 2006) on Mount Maquiling, near the School of Forestry. The gray color of No. 2006 is strongly pronounced; the black color of the body merely borders the yellow crossbands. No. 301 has the loreal entering the eye; in No. 2006 the loreal is separated from the orbit by the preocular; the second pair of chin shields is smaller.

*Scale counts.*—No. 301: Ventrals, 221; subcaudals, 94. No. 2006: Ventrals, 227; subcaudals, 95. No. 301 has 74 yellow bars; No. 2006 has 100.

*Remarks.*—The fact that the specimens of *Boiga dendrophila* from Luzon and Polillo (the Samar record <sup>13</sup> is doubtful) show more resemblance to the Palawan form than to the Mindanao form is rather inexplicable. Using reptiles and amphibians as criteria there is very little evidence to show that Palawan has ever had any land connection with any part of the Philippines east of the Sulu Sea. In consequence, we would expect that

<sup>13</sup> Taylor, loc. cit.

a Luzon form would show more similarity to the well-defined color form of *Boiga dendrophila latifasciata* which occurs in Mindanao. It is, of course, not improbable that both subspecies occur in Mindanao. However, no specimen of *B. d. divergens* has been found there.

***Hemibungarus calligaster* (Wiegmann).**

*Elaps calligaster* WIEGMANN, Nova Acta Acad. Leop.-Carol. 1 17 (1835) 253, pl. 20, fig. 2.

*Hemibungarus calligaster* TAYLOR, Snakes of the Philippine Islands (1922) 269.

Three specimens of this species were obtained at Los Baños; one through the courtesy of Prof. Charles Fuller Baker, dean of the College of Agriculture, the other two from Prof. O. W. Pflueger, director of the School of Forestry. No. 40 presents an interesting variation in the relative length and width of the body, as shown by the table. It varies also from the normal in having the first lower labials separated and the mental in contact with the first pair of chin shields. This condition is also present in No. 41. The very low subcaudal count and the high ventral count of No. 40 are also extraordinary. The tail is doubtless abnormal; there is no evidence that the shortening is due to injury.

It is presumed that these specimens were collected low on Mount Maquilang, about the grounds of the College of Agriculture and the School of Forestry.

*Measurements and scale counts of Hemibungarus calligaster (Wiegmann).*

	No. 40, ♀	No. 54, ♀	No. 41, ♂
Width of body .....	6	9	9
Width of head .....	5.5	8.5	7
Length .....	460	508	455
Tail .....	18	26	25
Ventrals .....	256	224	228
Subcaudals .....	12	20	20
Lower labials .....	5	7	6
Labials touch chin shields .....	3	4	3

***Hemibungarus mclungi* Taylor.**

*Hemibungarus mclungi* TAYLOR, Snakes of the Philippine Islands (1922) 272, pl. 33, fig. 3; pl. 34, figs. 3 and 4.

A specimen of this rare snake was taken on the road to Bislian on Polillo. However, it was attacked by ants when killed and certain of the head scales were destroyed. The characteristic shape of the frontal plate is clearly evident. Total length, 310



millimeters; tail, 26. Anal, single; ventrals, 204; subcaudals, 22.

*Color in life.*—The body is nearly black above with very indistinct dotted bands of cream on neck; belly banded with intense black and coral red, the red lighter on neck. The black bands below, each incorporating an elongate narrow white stripe.

The species is obviously distinct from *Hemibungarus calligaster* and is very probably confined to Polillo or the Polillo group of islands.

*Doliophis philippinus* (Günther).

*Callophis intestinalis* var. *philippina* GÜNTHER, Rept. Brit. India (1864) 349.

*Adenophis philippinus* MEYER, Sitzb. Ber. Ak. Wiss. Berlin 36 (1886) 614.

*Doliophis philippinus* TAYLOR, Snakes of the Philippine Islands (1922) 277, pl. 35, figs. 1 and 2.

A single specimen of this rare species was collected in the mountains lying back of the Zamboanga waterworks intake. It was found near the summit, under a decayed log. When disturbed the tip of the tail was turned up to display the bright red spots beneath.

*Description of specimen.*—(No. 1100, E. H. Taylor collection.) Female. Total length, 390 millimeters; tail, 26; width of head, 4.5; length, 7.5. Ventrals, 260; subcaudals, 21; anal, single.

*Color in life.*—Above brown with a black median stripe covering three whole and two half rows of scales, inclosing longitudinal brown spots much longer than the interspaces between them; on either side of the black stripe are narrow brown stripes covering parts of two scale rows; below these a narrow black line which merges in the large black blotches on the belly; black blotches separated by pink to flesh white blotches, which reach the third outer scale row on side; spots below tail bright red.

*Naja naja philippinensis* Taylor.

*Naja naja philippinensis* TAYLOR, Snakes of the Philippine Islands (1922) 265.

I have obtained two adult specimens of the Philippine brown cobra; one (No. 869) from Los Baños, presented to me by Prof. C. F. Baker, dean of the College of Agriculture, and a second specimen, collected near Antipolo by Mrs. R. M. McCrory. The Los Baños specimen has a very much longer head than the Antipolo specimen. The measurements are 52 and 43 millimeters, respectively.

*Measurements and scale counts of Naja naja philippinensis Taylor.*

	No. 869, ♂.	No. 000, ♂.
Length ----- mm	1,423	1,120
Tail ----- mm	195	140
Ventrals -----	190	184
Subcaudals -----	46	40
Upper labials -----	7	7
Lower labials -----	8-9	9
Scale rows:		
Neck -----	25	23
Body -----	21	21

*Naja naja samarensis (Peters).*

*Naja tripudians* var. *samarensis* PETERS, Mon. Berl. Ak. (1861) 690.

*Naja naja samarensis* TAYLOR, Snakes of the Philippine Islands (1922) 259.

A single specimen of this subspecies was collected near a trail which follows Tumugao River, some 20 kilometers from Zamboanga.

*Color in life.*—The specimen is uniform black; the skin between scales, bright yellow. None of the scales has yellow spots. Chin yellow. Beginning with the fifth ventral the following twenty scales are deep black, gradually becoming cream. Outer edge of ventrals of most of the scales with dusky spots.

This subspecies is not rare in Zamboanga; several of the snakes have been seen or killed on the golf links.

*Measurements and scale counts of Naja naja samarensis (Peters).*

Length (mm.)	1,010
Tail (mm.)	165
Ventrals	173
Subcaudals	48
Scale rows on neck	21
Scale rows around body	19
Upper labials	7
Lower labials	8
Labials touching first chin shields	4

*Trimeresurus wagleri wagleri (Boie).*

*Trimeresurus wagleri wagleri* TAYLOR, Snakes of the Philippine Islands (1922) 298.

A specimen of this subspecies has been recently obtained from Balabac Island. It is uniformly green above, with two series of very small white dots on the back. The tail is brown on the tip, and has several larger white dots. Ventrals, 142; anal, single; subcaudals, 51. The subocular is separated from the labials.

## ILLUSTRATIONS

### PLATE 1

- FIG. 1. *Rana yakani* sp. nov.; photograph of a cotype specimen from Basilan, about natural size.
2. *Rana suluensis* Taylor; photograph of specimen from Jolo, enlarged.
3. *Micrixalus diminutiva* sp. nov.; photograph of cotype specimen from Zamboanga; actual length, snout to vent, 20 millimeters.
4. *Micrixalus diminutiva* sp. nov.; photograph of cotype specimen from Zamboanga; actual length, snout to vent, 20 millimeters.

### PLATE 2

- FIG. 1. *Rana yakani* sp. nov.; photograph of No. 1027, male, a cotype specimen from Zamboanga; actual length, snout to vent, 48 millimeters.
2. *Micrixalus diminutiva* sp. nov.; photograph of the type specimen, from Zamboanga; actual length, snout to vent, 21 millimeters.
3. *Micrixalus diminutiva* sp. nov.; photograph of a specimen from Jolo; actual size, snout to vent, 20 millimeters. Note the lesser extent of webbing on hind foot.

### PLATE 3

- FIG. 1. *Rana igorota* sp. nov.; photograph of a cotype from Kalinga, about natural size.
2. *Polypedates linki* sp. nov.; photograph of the type specimen.

### PLATE 4

- FIG. 1. *Tropidophorus stejnegeri* sp. nov.; photograph of the type. The characteristic markings on the back fail to appear in the photograph.
2. *Dibamus argenteus* Taylor; anal region, from a Basilan specimen; enlarged.
3. *Cornufer rivularis* sp. nov.; photograph of the type specimen.
4. *Cornufer montanus* sp. nov.; photograph of the type specimen.







PLATE 1.



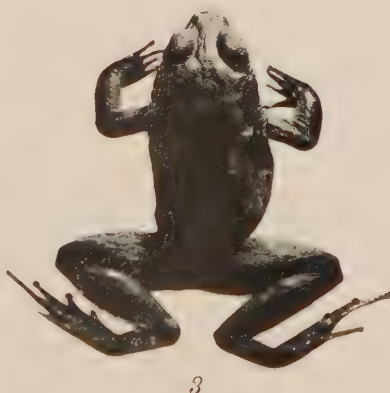


PLATE 2.







PLATE 3.





PLATE 4.





CORRELATION OF DEATH RATES FROM CERTAIN  
DISEASES WITH CERTAIN ECONOMIC AND  
HOUSING FACTORS IN THE PHILIPPINE  
ISLANDS <sup>1</sup>

By RUFINO ABRIOL

ONE TEXT FIGURE

INTRODUCTION

In the work of a health officer there constantly arises a multiplicity of problems which cannot possibly be correctly solved without the application of modern statistical methods. Essential among these methods is correlation. "By the use of this technique, the most complicated problems, which could be attacked in no other way, may be solved." (7) While other statistical methods are being applied to public-health problems with considerable frequency, it can reasonably be said that this is not generally done with the method of correlation. In the solution of biological, anthropological, meteorological, social, and economic problems the theory has found application, but in the domain of vital statistics little use has been made of it.

It is gratifying to realize that in its meager use in vital statistics it has thrown light on numerous fundamental as well as surprising interrelationships between various phenomena; for example, compare Pearl's work on the epidemiology of influenza. (6, 8)

In considering the general health conditions of a community, such as the prevalence of disease, malnutrition, infant mortality, general morbidity, etc., it is generally assumed that there must be a certain relation between these and the housing conditions or economic factors. It is possible that scientific analysis would show that these accepted relations are not so intimate as is generally believed. Also, there is the possibility that the similarity of conditions might not hold universally. As the material herein finds its source in the Philippine Islands, it should be

<sup>1</sup> Papers from the department of biometry and vital statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 49.

borne in mind that variation in conditions doubtless is in some degree responsible for the results here presented.

Concretely, in the Philippine Islands, of necessity, the dwellings are of a construction far different from that found in America or Europe. Whereas in occidental countries warmth, together with protection, must be considered in the construction of homes, in the Philippines, since there exists no need of heating the houses, a loose construction is common that affords perfect ventilation. Thus we find a fundamental difference.

The size of the family per housing unit is generally taken as a criterion of "crowding." In America the evil of this is mostly felt in centers of population, and it is especially among the poorer class and foreign element that this condition flourishes. In the Philippines it must be acknowledged that the same number of people could live under a given roof, the ratio of which would be considered "crowding" in America, and not have the same injurious effect on the health of the Filipinos, due to the difference in climate, ventilation, etc. In fact, with the poorer class, which constitutes the bulk of the population, it is a common occurrence to find several families not only under the same roof but also living in the same room. Consequently, it would appear that, with such close relationships, the possibility of interdetrimentalness would be greater than in the United States; but the neutralizing effect of the facts that dwellings cannot be closed and that they have at all times perfect ventilation must be considered. Therefore, though the figures may show the index of "crowding" in the United States to check numerically that of the Philippines, yet upon application of the correlation method to death rates the resulting effects may be found different, due to other factors. Such was actually found to be the case.

#### FACTORS CORRELATED

In the development of this idea, by the method of correlation, certain Philippine data were analyzed. For simplicity and with a view to further work along this line, the diseases selected as best suited for this problem are malaria, smallpox, Asiatic cholera, dysentery, leprosy, beriberi, and pulmonary tuberculosis; and, lastly, all causes of death combined were considered. The diseases named are those adopted in the standard classification of the International Nomenclature of Causes of Death. Also, this classification is strictly adhered to in the annual reports of the Philippine Health Service, and was furthermore adopted in the Philippine Census of 1918. The death rates from these dis-

eases per 1,000 population in the various provinces have been correlated with certain economic and housing factors. Thus, should the results warrant following up this problem, there would be a satisfactory basis for comparative work.

#### SOURCE AND NATURE OF DATA

The data in this work are drawn from the Philippine Census of 1903, taken in March of that year. Therefore, the figures on economic factors, dwellings, and families represent those existing during the early part of 1903. For that year only partial and rather incomplete data on vital statistics are included, while for 1902 comprehensive figures are available. As the census gives figures on the economic, dwelling, and family factors for the early part of 1903, it is considered that the statistics on mortality for 1902 are sufficiently closely related in point of time. Therefore, the data of vital statistics for 1902 and the figures for the economic, dwelling, and family factors for 1903 are herein analyzed.

In considering the provinces with reference to their population and relative wealth, a difficulty presents itself. The objective is the finding of the ratio between the wealth of the provinces and their respective population that will give a concrete measure for statistical use. As the determination of the income of the people is not feasible, the valuation of taxes and personal property and real estate are primarily considered. It seems fairly reasonable to assume that the taxes paid by a community furnish a measure of its wealth. Likewise, the valuation of the personal property and real estate must serve a similar purpose. However, the question that arises is: To what degree can these elements be properly regarded as the measure of the economic status of the province and its people? Total taxes paid or the total value of personal property and real estate does not seem to furnish as true an index of the wealth of the community as when these values are considered with respect to the individuals inhabiting the province. Consequently, the figures have been taken on a per capita basis, and both taxes and property valuations have been used for the correlations.

The property values include personal and real property as given in the census. The taxes do not include customs collections; they do, however, cover the amount of taxes paid for insular, provincial, municipal (town or city), and road purposes. Both the property and the tax values were estimated in the various parts of the Islands by tax assessors, appraisers, the

presidentes,<sup>2</sup> or by the owners of the property. Therefore, although the figures do not represent actual valuations, they can reasonably be accepted as good approximations, accurately comparable among themselves.

The word "family" is herein used in the sense in which it is employed in the United States Census; that is, "a group of persons living under one roof, or in one suite or apartment."<sup>(2)</sup> No distinction is made, however, between public and private families. A dwelling is considered as one roof, sheltering one or more families.

Certain provinces have been omitted, because of incomplete and unreliable records. Manila, being a city, is also omitted for the simple reason that conditions obtaining there are not comparable with those of the provinces. This is particularly true in respect to the family factor, in which are included a large number of institutions such as prisons, colleges, hospitals, etc. Thirty-nine provinces are included in this work, namely:

Abra.	Masbate.
Albay.	Mindoro.
Ambos Camarines.	Misamis.
Antique.	Nueva Ecija.
Bataan.	Nueva Vizcaya.
Batangas.	Occidental Negros.
Bohol.	Oriental Negros.
Bulacan.	Palawan.
Cagayan.	Pampanga.
Capiz.	Pangasinan.
Cavite.	Rizal.
Cebu.	Romblon.
Ilocos Norte.	Samar.
Ilocos Sur.	Sorsogon.
Iloilo.	Surigao.
Isabela.	Tarlac.
Laguna.	Tayabas.
La Union.	Zambales.
Leyte.	Zamboanga.
Marinduque.	

#### THE CORRELATION METHOD

A brief explanation of the correlation method may be of advantage to those not familiar with it. This method was first introduced on a sound basis by Galton,<sup>(4)</sup> and later elaborated by Edgeworth,<sup>(3)</sup> Pearson,<sup>(9)</sup> Yule,<sup>(11)</sup> and others. "Two characteristics are said to be correlated when there is a tendency for the changes in the value of one to depend on the

<sup>2</sup> The presidente is an official corresponding to the mayor in an American township or city.



changes in the value of the others.”(5) For instance, were death rates and taxes correlated in the various provinces, it would be found that the high death rates occur in the provinces where the taxes are high. This is positive correlation. If, on the other hand, the high death rates were found in provinces where taxes are low, there would also be correlation, but in this case a negative correlation.



FIG. 1. Correlation between death rate per 1,000 population from tuberculosis (left column) and average number of persons to a dwelling (right column) in certain provinces of the Philippine Islands.

The application of the theory of correlation involves numerous mathematical computations. The simplest method enables one to determine roughly the degree of correlation between two

variables by a simple diagram, such as is shown in fig. 1, without entailing mathematical calculations. Such a method, however, does not enable one to measure the degree of association or correlation. From mere inspection of fig. 1, one may deduce that the higher rates correspond to, or, to use the statistical term, are "correlated" with, the lower figures in the dwellings.

The underlying principle of the method of correlation is the measurement of the association between two values in terms of the coefficient of correlation. This coefficient is expressed as follows:

$$r_{12} = \frac{\sum (x_1 \cdot x_2)}{N \sigma_1 \sigma_2}$$

where

$r_{12}$  = the correlation coefficient

$X_1$  and  $X_2$  = the variables correlated

$x_1$  and  $x_2$  = the deviations from the means of  $X_1$  and  $X_2$ , respectively

$\Sigma$  = summation

$\sigma_1$  and  $\sigma_2$  = the standard deviations of  $X_1$  and  $X_2$

$N$  = number of observations (variates).

The coefficient may vary from 0 to 1, in either the positive or the negative direction, depending upon the nature of the correlation. The numerical value of this coefficient expresses the degree of association, approaching complete correlation as the value approaches unity. In other words, if the value is either  $-1$  or  $+1$ , the correlation is perfect; that is, for every change in one variable, there is a definite and constant proportional change in the other.

$\sigma_1$  and  $\sigma_2$  are derived according to the following formula:

$$\sigma = \frac{\sum (x^2)}{N}$$

$N$  = number of pairs

$\Sigma$  = summation of  $x^2$ .

Before conclusions can be drawn from the coefficient of correlation it is necessary to know something about the probable error. The probable error is a conventional measure of the reliability of results.

It is a constant so chosen that when its value is added to and subtracted from the result obtained or the numerical conclusion reached, it is exactly an even chance that the true result or conclusion lies either inside or outside the limits set by the probable error in the plus and minus direction.

For example, if it is stated that the mean age of death of persons dying in Baltimore is  $39.83 \pm 2.60$  years, it means that the mathematical probability that the true average age falls between 37.23 years ( $39.83 - 2.60$ ) and 42.43 years ( $39.83 + 2.60$ ) is exactly equal to the mathematical probability that the true age falls outside those limits.(7)

The significance of our results, therefore, can be judged only after considering their relation to their probable errors. Bowly and Hooker(6) consider that when the correlation coefficient is six or more times the probable error it is practically certain that the two factors in question are associated; that is, the coefficient is significant. Raymond Pearl(7) considers a coefficient not significantly different from 0 when it is not more than four times its probable error. This basis of interpreting the probable error and coefficient will be considered as the criterion of significant results in this paper.

#### ANALYSIS OF RESULTS

The death rates from the diseases under consideration in the thirty-nine provinces are each correlated with the values of the personal property and real estate per capita, with taxes per capita, and with the average number of persons to a dwelling. Table 1 shows the means and the standard deviations of the factors entering into the correlation. Table 2 shows the correlation coefficients. Casual examination of this table reveals a most interesting and rather surprising result, in as much as the coefficients are for the most part contrary to what was expected. For a closer scrutiny and analysis, each of the diseases is considered separately.

TABLE 1.—*Means and standard deviations of death rates from certain diseases and certain economic and housing factors.*

Variable.	Mean.	Standard deviation.
Death rate from all causes .....	61.57 $\pm$ 2.63	24.38 $\pm$ 1.86
Malaria .....	17.19 $\pm$ 1.07	9.87 $\pm$ 0.75
Smallpox .....	1.99 $\pm$ 0.35	3.23 $\pm$ 0.25
Asiatic cholera .....	18.80 $\pm$ 1.45	13.40 $\pm$ 1.02
Dysentery .....	2.55 $\pm$ 0.21	1.98 $\pm$ 0.15
Leprosy .....	0.017 $\pm$ 0.002	0.017 $\pm$ 0.001
Beriberi .....	0.67 $\pm$ 0.06	0.55 $\pm$ 0.04
Pulmonary tuberculosis .....	4.35 $\pm$ 0.26	2.42 $\pm$ 0.19
Real estate .....	78.24 $\pm$ 6.19	57.32 $\pm$ 4.38
Taxes .....	0.96 $\pm$ 0.07	0.68 $\pm$ 0.05
Family .....	4.70 $\pm$ 0.06	0.52 $\pm$ 0.04
Dwelling .....	5.55 $\pm$ 0.06	0.53 $\pm$ 0.04

TABLE 2.—Coefficients of correlation between death rates from certain diseases and certain economic and housing factors.

Death rate from—	Correlated with—			
	Personal property and real estate.	Taxes.	Persons in family.	Persons in dwelling.
All causes .....	+0.18±0.10	+0.36±0.09	−0.52±0.08	−0.32±0.10
Malaria .....	+0.12±0.11	+0.26±0.10	−0.22±0.10	−0.05±0.11
Smallpox .....	−0.08±0.11	−0.10±0.11	+0.17±0.10	−0.09±0.11
Asiatic cholera .....	+0.01±0.11	+0.42±0.09	−0.49±0.08	−0.10±0.11
Dysentery .....	+0.11±0.11	−0.12±0.11	−0.39±0.09	−0.31±0.10
Leprosy .....	−0.19±0.10	−0.04±0.11	−0.09±0.11	−0.23±0.10
Beriberi .....	+0.13±0.11	−0.11±0.11	+0.06±0.11	+0.03±0.11
Pulmonary tuberculosis .....	+0.37±0.09	+0.06±0.11	−0.42±0.09	−0.53±0.08

*All causes.*—The coefficient with personal property and real estate is +0.18, which, considered with its probable error,  $\pm 0.10$ , is not significantly different from 0. The coefficient with taxes is just four times its probable error and, therefore, probably though not surely significant. The coefficient with the average number of persons to the family is high, revealing a negative association of the rates with the number of persons in the family; in other words, high death rates occur in provinces where families are small.

*Asiatic cholera.*—The coefficients with taxes and with number of persons to the family are both significant. It is judged from this that the death rates from cholera are higher among the people in provinces where higher taxes per capita are paid. It furthermore means that the rates are inversely proportional to the number of persons in the family. There is, however, an apparent anomaly in the death rates having a negative correlation with the number of persons in the family and no correlation with the number of persons in the dwelling, considering the fact, alluded to above, that families and dwellings are factors of practically the same nature.

*Dysentery.*—Economic factors show no association with death rates from dysentery. Number of persons in the family, however, appears to be slightly negatively associated with the rates.

*Pulmonary tuberculosis.*—In this disease, as in all causes, Asiatic cholera, and dysentery, the association with the number of persons in the family is apparent. Unlike any of the others, however, the correlation with the number of persons in the dwelling is high and negative; in fact, the coefficient for this is the highest obtained in the whole series. This suggests that,



owing to the general social condition obtaining in the Philippine population, the usual relations respecting familial infection are somewhat upset. Taxes, as a factor, show no association. The correlation coefficient with personal property and real estate is shown in Table 2 as being slightly more than four times the probable error. The actual figures, carried to four decimal places, however, are  $+0.3708$  with a probable error of  $\pm 0.0932$ , the former being slightly less than four times the latter. The coefficient, therefore, does not certainly indicate any association of death rates with real estate.

*Malaria, smallpox, leprosy, and beriberi.*—None of the coefficients for these diseases has any significance.

#### DISCUSSION

The results presented must be regarded as entirely preliminary to more-detailed statistical analysis. There is involved an element of spurious arithmetical correlation due to the fact that the data correlated are rates having the same denominator for both deaths and economic and social variables. However, it is believed that the preliminary gross results here presented have considerable suggestive value. Yule<sup>(12)</sup> has argued that in such death-rate correlations the gross coefficients (which include the so-called spurious element) have real significance because they represent what is really the actuality. Greenwood's<sup>(1)</sup> study of death-rate correlations of cancer and diabetes appears to bear out this contention. Pending further analysis by the methods of partial correlation, to eliminate wholly the spurious element, the present conclusions should be accepted with caution and reservation.

In the consideration of the various correlations it is deemed necessary to note just what may be the effects of civilization upon a people like the Filipinos, presenting as they do a population of heterogeneous character. Down through history, the acquisition of civilization by the so-called primitive peoples has been followed by a general weakening of their natural powers. Attention is drawn to its effects upon the American Indians, for instance. Since they, as nations, possessed no acquired specific immunity against the diseases that follow closely in the path of civilization, they easily succumbed to them. Another effect, closely allied, is the influence upon the size of the families. It is not the general trend of sociological development that the less-enlightened peoples have larger families than those endowed with the benefits of culture and civilization?

Furthermore, it is generally conceded that the people of the better and wealthy class, who naturally represent the portion of the population possessing higher culture and civilization, appear to have lower resistance to disease than the lower and poorer class, who are hardy and live close to nature. The families of the latter class are large; many families live under the same roof; however, due to the climate, they do not cling to the dwelling as do the better and wealthier class. Thus, a large number of persons in the family or dwelling among these people is only an apparent crowding and not a real one.

None of the diseases except Asiatic cholera exhibits association with either real estate or taxes per capita. In cholera there seems to be a definite correlation with taxes, indicating that in the Philippine Islands the death rates from this disease are found highest in the provinces where the population pays relatively higher taxes. If the amount of taxes per capita in a province can be considered as a fair index of the wealth of the population, the conclusion that can be tentatively drawn from this coefficient is that the wealthier the people the more liable they are to infection from cholera. This seemingly puzzling phenomenon is precisely what would be expected if we were to consider the effects of civilization as referred to above. Examination of the data reveals the fact that where death rates are highest, the provinces concerned possess a population of a higher culture than do those which present lower death rates.

The results with the housing factors are likewise puzzling. If the coefficients are to be taken as a true measure of correlation between the death rates and the housing factors, at least as far as all causes, Asiatic cholera, dysentery, and pulmonary tuberculosis are concerned, higher rates are found in provinces where the families are smaller, and in the case of tuberculosis, also, where the average number of persons to a dwelling is lowest. Again, the effects of civilization are offered as a possible explanation of this phenomenon. It has been suggested above that civilization tends to make the families smaller; likewise, it is pointed out that morbidity increases with the advance of civilization. It may be, then, the combined effects of these factors that influence the correlation of death rates with the housing variables. It is to be remembered that the poorer and less-enlightened class is the one that possesses larger families and dwellings with a larger number of occupants. It must be remembered, too, that only numerical crowding exists, and that the dwellings are well ventilated. Then there is the

possibility that the more crowded the dwellings are the greater will be the tendency for the people to live out of doors. They are, consequently, the hardy type, the outdoor-loving people, and therefore the class that possesses higher resistance to disease. This assumption is apparently borne out by the fact that in the provinces in which the death rates are lower and the families larger the population belongs to that class.

TABLE 3.—Deaths from certain principal causes in certain provinces, Philippine Islands. Data for 1902, Philippine Census, 1903.

Province.	Cause of death.							
	All causes.	Malaria.	Small-pox.	Asiatic cholera.	Dysentery.	Leprosy.	Beriberi.	Tuberculosis.
Abra .....	1,296	398	1	464	41	0	6	133
Albay .....	11,564	3,103	1,239	480	279	2	187	815
Ambos Camarines .....	10,872	2,634	1,189	1,144	327	1	494	1,309
Antique .....	7,411	3,181	173	827	372	1	19	826
Bataan .....	4,479	613	3	2,252	218	0	29	406
Batangas .....	34,257	13,216	44	10,383	1,784	2	282	1,747
Bohol .....	10,851	2,748	425	4,883	279	3	30	542
Bulacan .....	13,015	2,041	248	2,494	413	1	198	1,602
Cagayan .....	9,783	2,724	2,418	1,375	249	8	57	557
Capiz .....	15,564	3,254	694	5,903	1,339	4	263	949
Cavite .....	8,983	2,073	289	1,893	374	2	87	744
Cebu .....	20,920	7,020	1,269	5,800	216	20	673	1,001
Ilocos Norte .....	10,657	2,236	233	3,907	1,057	11	28	488
Ilocos Sur .....	12,694	1,214	4	8,187	293	7	13	521
Iloilo .....	51,153	16,572	33	21,772	645	5	168	2,028
Isabela .....	4,584	1,357	569	861	267	1	23	257
Laguna .....	15,918	4,877	2	4,763	806	3	241	1,987
La Union .....	8,821	1,008	449	4,647	696	4	30	333
Leyte .....	17,016	5,011	2,465	3,618	269	8	381	594
Marinduque .....	3,222	1,466	0	265	156	0	43	252
Masbate .....	1,881	811	18	664	9	0	7	72
Mindoro .....	2,466	621	113	854	226	0	66	139
Misamis .....	9,038	4,961	0	2,386	155	3	190	361
Nueva Ecija .....	8,487	2,553	121	1,642	332	5	75	720
Nueva Vizcaya .....	1,228	511	1	433	14	0	1	60
Occidental Negros .....	24,461	3,220	17	12,710	837	2	72	1,390
Oriental Negros .....	5,972	2,135	77	1,875	110	8	92	492
Palawan .....	664	160	0	185	26	0	19	47
Pampanga .....	14,383	3,247	127	2,672	502	1	60	1,352
Pangasinan .....	24,701	6,531	104	9,536	1,028	22	86	1,905
Rizal .....	11,883	1,648	148	3,370	453	3	187	1,167
Romblon .....	1,422	531	0	164	30	2	33	178
Samar .....	13,614	3,913	1,789	4,226	253	9	235	320
Sorsogon .....	4,380	998	82	310	157	1	92	391
Surigao .....	3,304	1,200	35	1,142	25	1	62	216
Tarlac .....	7,088	2,453	55	1,464	143	1	34	653
Tayabas .....	9,418	3,501	1	1,569	680	1	254	1,075
Zambales .....	6,772	1,398	396	2,180	584	2	16	537
Zamboanga .....	1,559	366	0	752	64	0	1	41
All provinces .....	425,781	117,504	14,831	134,052	15,708	144	4,834	28,207



## SUMMARY

The coefficients obtained indicate that the death rate from Asiatic cholera are positively correlated with the taxes paid per capita in the provinces. In the provinces where higher taxes are paid, the death rates from this disease are higher.

TABLE 4.—Death rate per 1,000 population from certain principal causes in certain provinces of the Philippine Islands. Computed from Tables 3 and 5.

Province.	Cause of death.							
	All causes.	Ma-laria.	Small-pox.	Asiatic cholera.	Dysentery.	Lep-rosy.	Beri-beri.	Tu-bercu-losis.
Abra	34.26	10.52	0.03	12.27	1.08	0.000	0.16	3.52
Albay	48.30	12.96	5.17	2.00	1.17	0.008	0.78	3.40
Ambos Camarines	46.57	11.28	5.09	4.90	1.40	0.004	2.12	5.61
Antique	56.47	24.24	1.32	6.30	2.83	0.008	0.14	6.29
Bataan	99.17	13.57	0.07	49.86	4.83	0.000	0.64	8.99
Batangas	132.93	51.28	0.17	40.29	6.92	0.008	1.09	6.78
Bohol	40.30	10.21	1.58	18.14	1.04	0.011	0.11	2.01
Bulacan	58.28	9.14	1.11	11.17	1.85	0.004	0.89	7.17
Cagayan	68.50	19.07	16.93	9.63	1.74	0.056	0.40	3.90
Capiz	69.14	14.46	3.08	26.22	5.95	0.018	1.17	4.22
Cavite	66.65	15.38	2.14	14.05	2.77	0.015	0.65	5.52
Cebu	32.00	10.74	1.94	8.87	0.33	0.031	1.03	1.53
Ilocos Norte	60.28	12.65	1.32	22.10	5.98	0.062	0.16	2.76
Ilocos Sur	73.04	6.98	0.02	47.11	1.69	0.040	0.07	3.00
Iloilo	126.64	41.03	0.08	53.90	1.60	0.012	0.42	5.02
Isabela	66.63	19.73	8.27	12.52	3.88	0.015	0.33	3.74
Laguna	107.12	32.82	0.01	32.05	5.42	0.020	1.62	13.37
La Union	69.03	7.89	3.51	36.36	5.45	0.031	0.23	2.61
Leyte	43.75	12.88	6.34	9.30	0.69	0.021	0.98	1.53
Marinduque	62.35	23.37	0.00	5.13	3.02	0.000	0.83	4.88
Masbate	43.07	18.57	0.41	15.20	0.21	0.000	0.16	1.65
Mindoro	76.30	19.22	3.50	26.42	6.99	0.000	2.04	4.30
Misamis	66.71	36.62	0.00	17.61	1.14	0.022	1.40	2.66
Nueva Ecija	63.81	19.20	0.91	12.35	2.50	0.038	0.56	5.41
Nueva Vizcaya	76.63	31.89	0.06	27.02	0.87	0.000	0.06	3.74
Occidental Negros	80.55	10.60	0.06	41.86	2.76	0.007	0.24	4.58
Oriental Negros	32.30	11.55	0.42	10.14	0.59	0.043	0.50	2.66
Palawan	23.01	5.55	0.00	6.41	0.90	0.000	0.66	1.63
Pampanga	64.60	14.58	0.57	12.00	2.25	0.004	0.27	6.07
Pangasinan	62.61	16.55	0.26	24.17	2.61	0.056	0.22	4.83
Rizal	80.02	11.10	1.00	22.69	3.05	0.020	1.26	7.86
Romblon	26.91	10.05	0.00	3.10	0.57	0.038	0.62	3.37
Samar	51.27	14.74	6.74	15.91	0.95	0.034	0.88	1.21
Sorsogon	36.36	8.29	0.68	2.57	1.30	0.008	0.76	3.25
Surigao	33.27	12.08	0.35	11.50	0.25	0.010	0.62	2.18
Tarlac	53.09	18.37	0.41	10.97	1.07	0.007	0.25	4.89
Tayabas	62.68	23.30	0.01	10.44	4.53	0.007	1.69	7.15
Zambales	66.80	13.79	3.91	21.50	5.76	0.020	0.16	5.30
Zamboanga	39.79	9.34	0.00	19.19	1.63	0.000	0.03	1.05
All provinces	63.19	17.44	2.20	19.89	2.33	0.021	0.72	4.19



In the case of all causes, Asiatic cholera, dysentery, and pulmonary tuberculosis, the higher death rates are found in the provinces where the average number of persons in the family is lower. In pulmonary tuberculosis alone there is a significant

TABLE 5.—*Civilized population, total dwellings and families, and average number of persons to a dwelling and a family in certain provinces of the Philippine Islands. Data for year 1903, Philippine Census, 1903.*

Province.	Population.	Dwelling.	Families.	Average persons per—	
				Dwelling.	Family.
Abra.....	37,823	7,177	9,072	5.27	4.17
Albay.....	239,434	39,720	50,563	6.03	4.74
Ambos Camarines.....	233,472	40,410	48,826	5.78	4.78
Antique.....	131,245	21,842	24,701	6.01	5.31
Bataan.....	45,166	8,432	9,928	5.36	4.55
Batangas.....	257,715	49,538	63,831	5.20	4.04
Bohol.....	269,223	45,687	46,901	5.89	5.74
Bulacan.....	223,327	47,212	49,266	4.73	4.53
Cagayan.....	142,825	27,297	28,328	5.23	5.04
Capiz.....	225,092	39,544	48,769	5.69	4.62
Cavite.....	134,779	29,124	33,853	4.63	3.98
Cebu.....	653,727	113,481	116,069	5.76	5.63
Ilocos Norte.....	176,785	35,811	43,773	4.94	4.04
Ilocos Sur.....	173,800	34,124	44,180	5.09	3.93
Iloilo.....	403,932	65,795	94,454	6.14	4.28
Isabela.....	68,793	13,814	14,627	4.98	4.70
Laguna.....	143,606	32,308	37,217	4.60	3.99
La Union.....	127,789	22,117	28,030	5.78	4.56
Leyte.....	388,922	69,526	71,659	5.59	5.43
Marinduque.....	51,674	8,550	9,445	6.04	5.47
Masbate.....	43,675	6,790	8,493	6.43	5.14
Mindoro.....	32,318	5,236	7,232	6.17	4.47
Misamis.....	135,473	21,443	25,611	6.32	5.29
Nueva Ecija.....	132,999	26,630	30,664	4.99	4.34
Nueva Vizcaya.....	16,026	3,269	4,470	4.90	3.59
Occidental Negros.....	303,660	48,030	68,027	6.32	4.44
Oriental Negros.....	184,389	30,889	36,970	5.99	5.00
Palawan.....	28,852	4,928	6,420	5.85	4.49
Pampanga.....	222,656	40,994	47,257	5.43	4.71
Pangasinan.....	394,516	75,652	92,080	5.21	4.28
Rizal.....	148,502	31,466	31,957	4.72	4.65
Romblon.....	52,848	8,726	11,046	6.06	4.78
Samar.....	265,549	46,428	56,121	5.72	4.73
Sorsogon.....	120,454	21,205	23,582	5.68	5.11
Surigao.....	99,298	15,620	17,265	6.86	5.75
Tarlac.....	133,513	26,820	31,029	4.98	4.30
Tayabas.....	150,262	28,302	32,231	5.31	4.66
Zambales.....	101,381	19,675	21,810	5.15	4.65
Zamboanga.....	39,177	6,445	7,408	6.08	5.29
All provinces.....	6,740,177	1,220,057	1,433,465	5.52	4.70

correlation with the number of persons to the dwelling. The coefficient being negative, the conclusion suggested is that pulmonary tuberculosis brings about a higher death rate in less-

TABLE 6.—*Taxes, personal property and real estate in certain provinces in the Philippine Islands. Data for year 1903, Philippine Census, 1903.*

[One peso Philippine currency is equivalent to 50 cents United States currency.]

Province.	Population.	Personal property and real estate.	Total taxes.	Per capita—	
				Personal property and real estate.	Taxes.
		Pesos.	Pesos.	Pesos.	Pesos.
Abra .....	37,823	2,519,141	24,437	66.60	0.65
Albay .....	239,434	20,093,494	209,519	83.92	0.88
Ambos Camarines .....	233,472	19,145,796	185,404	82.01	0.79
Antique .....	131,245	4,729,448	73,203	36.04	0.56
Bataan .....	45,166	4,192,727	64,882	92.83	1.44
Batangas .....	257,715	16,746,641	94,016	64.98	0.36
Bohol .....	269,223	10,339,489	108,313	38.40	0.40
Bulacan .....	223,327	23,092,072	133,512	103.40	0.60
Cagayan .....	142,825	8,463,750	137,155	59.26	0.96
Capiz .....	225,092	14,749,631	116,962	65.53	0.52
Cavite .....	134,779	9,516,387	109,927	70.61	0.82
Cebu .....	653,727	28,006,833	1,062,346	42.84	1.63
Ilocos Norte .....	176,785	9,838,973	127,156	55.66	0.72
Ilocos Sur .....	173,800	9,673,426	243,799	55.66	1.40
Iloilo .....	403,932	36,165,306	1,889,352	89.53	4.68
Isabela .....	68,793	3,897,809	95,662	56.66	1.39
Laguna .....	143,606	21,147,665	162,024	142.31	1.09
La Union .....	127,789	7,143,716	136,276	55.94	1.07
Leyte .....	388,922	36,751,003	243,750	94.49	0.64
Marinduque .....	51,674	5,384,084	37,411	104.19	0.72
Masbate .....	43,675	1,493,159	63,546	34.30	1.45
Mindoro .....	32,318	3,874,377	13,914	119.90	0.43
Misamis .....	135,473	5,392,473	107,261	39.80	0.79
Nueva Ecija .....	132,999	10,061,985	79,612	75.66	0.60
Nueva Vizcaya .....	16,026	1,013,865	12,005	63.26	0.75
Occidental Negros .....	303,660	24,866,738	269,961	81.89	0.89
Oriental Negros .....	184,889	9,507,844	132,740	51.43	0.72
Palawan .....	23,852	426,054	18,619	14.77	0.65
Pampanga .....	222,656	20,634,237	178,213	92.90	0.80
Pangasinan .....	394,516	23,802,738	300,380	73.01	0.76
Rizal .....	143,502	14,523,570	143,866	97.83	0.97
Romblon .....	52,848	1,673,029	52,137	31.66	0.99
Samar .....	265,549	13,439,701	87,057	50.61	0.33
Sorsogon .....	120,454	10,735,315	154,075	89.13	1.23
Surigao .....	99,298	3,499,377	66,263	35.24	0.67
Tarlac .....	133,513	51,764,605	105,650	337.71	0.79
Tayabas .....	150,262	18,827,450	203,001	125.30	1.35
Zambales .....	101,381	7,912,530	79,223	73.05	0.78
Zamboanga .....	39,177	1,883,335	47,423	48.07	1.21
All provinces .....	6,740,177	521,995,773	7,375,107	77.46	1.09

crowded dwellings. This, however, probably only means that both variables are correlated with other general social factors. All of the conclusions in this paper are to be regarded merely as suggestive rather than final, until they can be checked by further and more-refined statistical analysis.

#### ACKNOWLEDGMENT

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## ILLUSTRATION

### TEXT FIGURE

FIG. 1. Chart, showing correlation between death rate per 1,000 population from tuberculosis (left column) and average number of persons to a dwelling (right column) in certain provinces of the Philippine Islands.



NOTES ON THE LIOPTERINÆ WITH DESCRIPTIONS OF  
NEW SPECIES FROM THE ORIENTAL REGION  
(HYMENOPTERA, CYNIPIDÆ)

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ONE PLATE

In a recent sending by Prof. Charles F. Baker of parasitic Cynipidæ from the Oriental Region several new species were recognized as belonging to the Liopterinæ and are here described. The first and third specimens of each sex have been retained for the United States National Museum collection and the second and fourth paratypes returned to Professor Baker.

The subfamily Liopterinæ as here treated includes both *Dallatorrella* Kieffer, a genus which has been proposed<sup>1</sup> and made a separate subfamily since the publication of the last monograph on the Cynipidæ,<sup>2</sup> and the closely related genus *Mesocynips* Cameron, which the Tierreich placed provisionally in the Cynipinæ. It is distinguished from the Oberthürellinæ, known only from Africa, by the lack of a tooth on the hind femur and the absence of a spine on scutellum; but, like that subfamily, the Liopterinæ has the abdomen attached high on the propodeum instead of between the hind coxæ; has the first abdominal segment (petiole) plainly visible and longitudinally ridged; and has the fourth or fifth tergite (the third only in *Xenocynips*) largest when seen in side view with usually two, and often three, short tergites behind the petiole preceding this big segment, and these may or may not be tongue-shaped. Both subfamilies have a somewhat similar habitus, being relatively large, stout species with the mesoscutum coarsely and usually transversely sculptured. Two new genera have been added to the Oberthürellinæ since the Tierreich monograph, and a key to the genera compiled from the literature is here included for that subfamily also.

<sup>1</sup> Bull. Soc. ent. Ital. 41 (1911) 244-246.

<sup>2</sup> Dalla Torre and Kieffer, Das Tierreich, Lief. 24 (1910) 1-17.

*Key to the subfamilies.*

Hind femur with a conspicuous tooth or spine on underside between middle and apex. Scutellum prolonged behind into a long spine with a short tooth on each side at base (Plate 1, fig. 1). Africa.

Oberthürellinæ.

Hind femur unarmed. Scutellum not ending in a spine. Petiole longitudinally ridged and arising at or above middle of propodeum. Scutellum never with cup. Fourth or fifth tergite of abdomen largest when seen from side, and abdomen never knifelike as in *Ibalia*.

Liopterinæ.

*Key to the genera of the Oberthürellinæ.*

1. Metatarsus of hind leg as long as 2-5. The sharp rim of hind margin of the pronotum raised into a distinct vertical median tooth at anterior end of mesoscutum. Tooth on femur oblique with a conspicuous lobe between it and distal end. Petiole with two longitudinal ridges above converging anteriorly. Scutellum with three pits.

Tessmannella Hedicke.

Metatarsus of hind leg not as long as 2-5. Pronotum without distinct median tooth behind. Tooth on femur perpendicular without lobe between it and apex. Petiole with about eight parallel ridges..... 2.

2. Tergites 2 to 4 liguliform, fifth about equal to 2 to 4 united. Scutellum with three pits at base (Plate 1, fig. 1)..... Oberthürella Kieffer.
- Tergites 2 to 4 not liguliform, third tergite longest. Scutellum with two pits at base..... Xenocynips Kieffer.

*Key to the genera of the Liopterinæ.*

1. Metatarsus or second segment of posterior tarsus of female with a prolongation on one side as in *Ibalia* (Plate 1, fig. 2, c)..... 2.
- Metatarsus and second segment of posterior tarsus of male and female without such prolongation..... 4.
2. Prolongation is on metatarsus. Prothorax truncate. Petiole not over one-fourth length of abdomen. Scutellum rounded behind. Forewing margin ciliate ..... 3.
- Prolongation is on second tarsal segment. Prothorax not truncate. Petiole six to seven times as long as broad and almost equal to abdomen. Scutellum bidentate behind. Forewing margin not ciliate. Africa..... Plastibalia Kieffer.
3. Prolongation on inner side of metatarsus. Petiole three to four times as long as broad..... Pseudibalia Kieffer.
- Prolongation on outer side of metatarsus as in *Ibalia*. Petiole not longer than broad..... Paribalia gen. nov.
4. Petiole at least twice and usually three to four times as long as wide, as long as or longer than hind coxa, and one-third length of abdomen and attached tangent to its dorsal curvature. In side view tergite 4 largest in female..... 7.
- Petiole not longer than broad, shorter than hind coxa, attached to very front end of the abdomen in the usual position..... 5.
5. Antenna of male 14-segmented. Cubitus arising at or near middle of basal. In side view tergite 5 largest in female (Plate 1, figs. 5 and 6)..... Allocynips Kieffer.
- Antenna of male 15-segmented. Cubitus arising on upper quarter of basal ..... 6.





The genus is founded on a single species, *Paribalia borneana* sp. nov. from Borneo, which is here described.

*Paribalia borneana* sp. nov. Plate 1, fig. 2.

*Female*.—Black with abdomen, first and second legs, and tibia and tarsus of third red, rest of hind leg infuscated. Head from above transverse, broader than thorax, occiput concave, from in front widest at level of antennæ, finely punctate, covered with appressed white pubescence. Interocular space 0.56 eye. Eyes bare, oval, width 0.86 length. From each antenna a smooth shallow groove leads back on frons between lateral ocellus and eye, bounding a raised triangular area which bears the ocelli. Antennæ 13-segmented, all cylindrical and closely joined, lengths as 20 (width 8) : 9 : 14 (width 7) : 19 : 17 : 16 : 15 : 14 : 12 : 11 : 11 : 10 : 21 (width 10). Prothorax with setigerous punctures on sides, its truncation as broad as pronotum, more finely punctate and faintly margined on sides; hind margin raised into a broad, blunt, median tooth, which is prominent in profile. Mesoscutum broader than long, triangular in front, coarsely sculptured with about eight or nine sharp, transverse, interrupted ridges giving it the appearance of a wood rasp with a white hair arising behind each tooth. Parapsidal grooves complete, broader behind; median groove narrower and reaching forward halfway. Scutellum rounded behind, with large umbilicate punctures, base with two large, deep, smooth, quadrangular pits separated by a thin carina, sides deeply hollowed out and the impressed areas filled with close white pubescence. Mesopleura with a longitudinal groove in the central bare polished area, above and below which are pubescent areas. Metanotum with two medial pits. Sides of propodeum areolate and pubescent, its neck rugose and arising as far from hind coxæ as from metanotum. Hind legs much the stoutest. Hind tarsus longer than tibia, metatarsus about equal to three following, shorter than fifth (without its claw), its appendage on outer side not quite reaching end of second. Claws simple. Forewing not quite reaching tip of abdomen, distal half slightly smoky, pubescent and ciliate, veins brown, those inclosing radial cell very heavy. First abscissa of radius slightly curved, second straight and forming an angle of  $24^{\circ}$  with the slightly longer marginal, radial cell 2.9 times as long as broad. Cubitus faint, no costal hinge or areolet. Only subcosta of hind wing visible. Petiole with about twenty ridges. Abdomen longer than head and thorax, twice as long as high, width three-fourths height (Plate 1, fig. 2, a). Lengths of tergites measured along dorsal

curvature are as (petiole) 13 (width 26) : 33 : 21 : 27 : 75 : 32. Seventh not visible. Slight pubescent patches in middle of sides of 5 and larger ones on anterior half of 6. Ventral valves protruding horizontally with and slightly farther than the ventral spine. Ovipositor probably very long. Using width of head as a base the length of mesonotum ratio is 1.16; length of antenna, 2.1; wing, 2.7. Length, 4.5 millimeters.

*Male*.—Differs from female in abdomen being shorter than head and thorax, and in having a larger petiole. Dorsal lengths of tergites are as (petiole) 17 (width 19) : 27 : 20 : 23 : 19 : 16 : 19. Punctured and pubescent area near anterior margin of 5, larger one on 6, and covering 7. In side view the fourth tergite is largest. In ventral view the sternites are visible. Abdomen is twice as long as high, only slightly compressed, width seven-eighths height (Plate 1, fig. 2, b). The lengths of segments of antenna are as 16 : 9 : 13 : 19 : 19 : 19 : 18 : 18 : 17 : 15 : 14, rest broken off, all flagellar segments cylindrical and closely joined as in female. Length, 3.6 millimeters.

Described from 1 male and 1 female, collected at Sandakan, Borneo (C. F. Baker).

*Type*.—Catalogue No. 24375, United States National Museum. Type female and allotype.

#### Genus *ALLOCYNIPS* Kieffer

In addition to the characters given by Kieffer the following notes apply to all the species seen. Head broader than thorax, not broadened behind eyes. Malar space without groove. Cheeks margined. Antennæ 13-segmented in female, 14-segmented in male, filiform, all flagellar segments cylindrical in both sexes, segment 3 always shorter than 4. Truncation of prothorax nearly as broad as pronotum, margined, hind margin of pronotum forming a sharp rim raised above the level of adjacent mesoscutum and with or without an erect median tooth. Mesoscutum coarsely sculptured, low-arched. Scutellum without spine behind. Propodeum with its distinct neck for attachment of abdomen as far from hind coxæ as from metanotum, the usual carinæ stout, curved outward, inclosing an area crossed above the middle by a horizontal ridge, above which is a single median, and below two fainter longitudinal ridges. Wing margin ciliate, areolet and costal hinge wanting. Petiole longitudinally ridged, as long as broad in only one species (female unknown). Abdomen somewhat compressed in the females. In side view tergite 4 is largest in the males and 5 in the females, 2 and 3 and 2 to 4 not liguliform. In the females all the tergites back of 2 are



angled along median dorsal line so that abdomen is sharp-edged above, not so in males.

*Key to species of Allocynips Kieffer.*

1. Mesoscutum with sharp transverse ridges, an erect median tooth developed anteriorly on hind margin of pronotum..... 2.  
 Mesoscutum coarsely sculptured with deep punctures arranged somewhat in transverse rows, the hind margin of pronotum forming a sharp rim raised above the adjacent mesoscutum but not showing a median erect tooth ..... 3.
2. Mesoscutum without median groove. Radial cell 4.7 times as long as broad..... *A. ruficeps* Kieffer.  
 Mesoscutum with median groove posteriorly. Radial cell 2.9 times as long as broad..... *A. dyak* sp. nov.
3. Frons without antennal groove, ocelli not on elevated triangular area.  
 Scutellum with transverse groove at base in which are two or three longitudinal ridges—not two distinct pits ..... *A. malayensis* sp. nov.  
 Frons with distinct antennal grooves bounding the sides of a distinctly elevated area bearing the ocelli above. Scutellum with two distinct smooth pits separated by a thin septum..... 4.
4. Scutellum disk sharp-edged at side and behind, overhanging metanotum.  
 Radial cell clear, its veins heavy but not clouded..... *A. clara* sp. nov.  
 Scutellum not margined, not overhanging metanotum. Radial cell or its veins distinctly clouded..... 5.
5. Forewing clouded along veins of radial cell, the first cubital and apical cells clear. Abdomen not as long as rest of body. Radial cell broadest at base, 2.2 times as long as broad, first abscissa of radius at angle of 90° to second, which is straight and about equal to marginal so that radial cell is almost an isosceles triangle.  
*A. isosceles* sp. nov.  
 Forewing with first cubital, radial, and proximal third of apical cell clouded. Abdomen as long as rest of body..... 6.
6. Cheek 0.7 eye. Mesoscutum broader than long, dark red. Seventh tergite not visible. Ventral valve protruding but ventral spine inconspicuous. Radial cell broadest one-fourth way to apex, 3.6 times as long as broad, first abscissa of radius making angle of 130° with second, which is distinctly shorter than marginal.  
*A. borneensis* sp. nov.  
 Cheek half length of eye. Mesoscutum as long as broad, clay yellow. Seventh tergite distinctly visible. Ventral spine two to three times as long as broad..... *A. flaviceps* Kieffer.

*Allocynips ruficeps* Kieffer.

This species, the genotype, was described<sup>3</sup> in 1914 from a male from Luzon. In this sending were two males, one from Sandakan, Borneo (*Baker*) and one from Singapore (*Baker*) which agree with the description of *A. ruficeps*. When the antennæ are mounted in balsam and measured with a micrometer they are

<sup>3</sup> Philip. Journ. Sci. § D 9 (1914) 186.



found to be slightly longer (1.03 times) than the body. Using the width of the head as a base, the length of mesonotum ratio is 1.2; antenna, 3.7; wing, 3.2. Length, 4.9 and 6.7 millimeters.

*Allocynips dyak* sp. nov.

*Female*.—Resembles *Pseudibalia borneana* Weld in color and sculpture but entirely lacking the appendage at apex of the metatarsus. Ocelli on a triangular elevation on frons bounded laterally by the broad smooth antennal grooves. Interocular space 0.55 transfacial and area 1.1 times as broad as high. Malar space 0.58 eye. Facial line 0.8 transfacial. Antennae arising above level of middle of eyes, 13-segmented, lengths as (scape) 25 (width 9) : 10 : 16 (width 7) : 22 : 19 : 19 : 17 : 16 : 15 : 14 : 13 : 12 : 25 (width 11), all flagellar segments cylindrical, closely joined, gradually stouter toward apex. Radial cell 2.9 times as long as broad, cubitus reaching basal. Hind tibia as long as tarsus. Abdomen with lengths of tergites measured along dorsal curvature as (petiole) 10 (width 24) : 40 : 23 : 27 : 54 : 28, seventh not visible, ventral valves not protruding, tergite 5 microscopically punctate with sparsely pubescent patches on sides and a densely pubescent larger area on 6. Using width of head as a base the length of mesonotum ratio is 1.18; antenna, 2.35; wing, 2.77. Length, 4.2 millimeters; abdomen, 2.1; wing, 3.6; antenna, 3.

Described from 2 females collected at Sandakan, Borneo (*Baker*).

*Type*.—Catalogue No. 24376, United States National Museum. Type, female.

*Allocynips malayensis* sp. nov.

*Female*.—Black, antennae piceous, legs brown distally. Head transverse, broader than thorax, finely punctate except for a smooth but not grooved area above antennae, ocelli not on a prominently elevated triangle. Head not broadened behind eyes, cheeks margined. Median ridge from between antennae to clypeus. Facial line 0.89 transfacial. Interocular space 0.52 transfacial and area 1.1 times as broad as high. Malar space 0.64 eye, without groove. Antennae arising above middle of eyes, 13-segmented, lengths as (scape) 19 : 6 : 15 (width 6) : 21 : 20 : 19 : 17 : 16 : 14 : 11 : 10 : 9 (width 8) : 19, all flagellar segments cylindrical and closely joined. Pronotum broadly truncate, sides coarsely punctate, hind margin not raised into a median tooth but its sharp rim higher than adjacent mesoscutum, truncation margined on sides. Mesoscutum broader than long,

twice length of pronotum, with rows of umbilicate punctures giving effect of transverse ridges, parapsidal grooves complete. Scutellum rounded behind, not margined, coarsely punctured, base with transverse depression in which are longitudinal ridges, not two distinct pits. Mesopleura with a prominent shallow longitudinal groove below a bare polished area, above which under tegulæ is a large white pubescent depression. Propodeum conical, its neck rugose and shorter than the grooved petiole, sides areolate and pubescent, usual carinæ converging above, inclosed area crossed by a horizontal ridge above which is a single, and below are two fainter longitudinal ridges. Hind leg stoutest, tarsus longer than tibia, metatarsus longer than 2-4 but shorter than 2-5, claws simple. Forewing with the closed radial cell in a large cloud, its veins heavy, cell 3.6 times as broad as long, cubitus reaching basal just above middle, no costal hinge, no areolet, surface pubescent, margin ciliate. Abdomen as long as head and thorax, elliptical in outline from side, twice as long as high, slightly compressed, width 0.6 height, lengths of tergites measured along dorsal curvature as (petiole) 12 (width 25) : 30 : 19 : 19 : 64 : 19 : 18, pubescent area in center of tergite 5, broader one on 6 and on whole of 7. Ventral valves horizontal, prominent. Hypopygium occupying almost whole of ventral surface, ventral spine short. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 2.4; wing, 3. Length, 4 and 4.3 millimeters.

*Male*.—Antennæ 14-segmented, lengths (scape) 18 : 8 : 25 : 29 (width 9) : 30 : 30 : 30 : 29 : 28 : 27 : 26 : 26 : 25 : 32 (width 6). Abdomen shorter than head and thorax, lengths as (petiole) 13 (width 15) : 26 : 17 : 18 : 17 : 15 : 15, tergite 4 largest in side view, 5, 6, and 7 microscopically punctate, a few hairs in middle of 5, more in 6, and covering 7. Length, 2.9 and 4 millimeters.

Described from 2 females and 2 males collected at Sandakan, Borneo (*Baker*).

*Type*.—Catalogue No. 24377, United States National Museum. Type female and allotype.

*Allocynips clara* sp. nov.

*Male*.—Black; pronotum, mesoscutum, and base of scutellum red. Head coarsely rugose-punctate, with median ridge on sparsely pubescent face, ocelli on a coarsely sculptured triangular elevation bounded on sides by finely punctured antennal grooves. Interocular space 0.57 transfacial and area 1.1 times as broad as high. Malar space 0.5 eye. Antennæ 14-segmented, filiform, lengths as (scape) 26 (width 11) : 9 : 18 (width 9) : 24 (width

10) : 24 : 24 : 21 : 21 : 20 : 19 : 19 : 19 : 17 : 27 (width 9), all closely joined. Truncation of prothorax broad, smooth, slightly margined, hind margin a sharp raised rim without median tooth. Mesoscutum longer than broad, coarsely sculptured with deep setigerous punctures in transverse rows, complete parapsidal grooves faintly indicated, no median. Scutellum 0.43 mesoscutum; disk black, coarsely and deeply punctured above, margined, with vertical ridges below, overhanging metanotum; pits at base longer than broad, bottom flat, smooth and polished, separated by a septum; impressed areas on sides. Propodeum as in *A. malayensis*. Hind tarsus longer than tibia, metatarsus longer than 2-4, shorter than 2-5, claws simple. Forewing subhyaline, veins yellowish and not clouded. Surface bare back of submarginal as far as basal, rest pubescent, margin ciliate, cubitus reaching basal just above middle, radial cell closed, 3.1 times as long as broad, first abscissa of radius arcuate, 0.4 length of second which is nearly straight. Abdomen longer than thorax, length: width as 42.25, lengths of tergites measured along dorsal curvature as (petiole) 14 (width 27) : 46 : 27 : 27 : 21 : 20 : 30. In side view tergite 4 largest, 5 microscopically punctate with transverse line of pubescence near front margin, on front half of 6, and covering 7. Six sternites visible. Using width of head as a base the length of mesonotum ratio is 1.68; antenna, 2.66; wing, 2.65. Length, 5.1 millimeters; antenna, 4.1; abdomen, 2.1; wing, 4.

Described from 1 male from Dapitan, Mindanao (*Baker*).

*Type*.—Catalogue No. 24378, United States National Museum. Type male.

*Allocynips isosceles* sp. nov. Pl. 1, fig. 5.

*Female*.—Red. Head finely punctate. Median ridge on face developed only between antennæ. Facial line 0.84 transfacial, clypeus broadly emarginate. Interocular space 0.53 transfacial and area 1.0 times as broad as high. Malar space 0.48 eye. Antennæ 13-segmented, lengths as (scape) 19 : 8 : 12 (width 5) : 18 : 15 : 14 : 14 : 13 : 12 : 11 : 11 : 10 : 22 (width 9), flagellum gradually becoming stouter toward apex. Truncation of prothorax margined, as broad as sides which are coarsely punctate. Mesoscutum broader than long, with setigerous punctures in transverse rows, complete parapsidal grooves indicated. Scutellum 0.69 length of mesoscutum, disk with large umbilicate punctures, not margined or overhanging metanotum, pits at base smooth, circular, reaching 0.3 way back, separated by a thin



septum. Hind tarsus longer than tibia, metatarsus longer than 2-4 but shorter than 2-5. Wing subhyaline, radial cell closed, its veins clouded, 2.2 times as long as broad, first abscissa of radius arcuate and one-third length of second which is straight and equal to marginal with which it makes an angle of  $25^{\circ}$ . First cubital cell narrower at base. Surface brown pubescent, margin ciliate. Abdomen longer than thorax, height 0.63 and width 0.5 length, lengths of tergites measured along dorsal curvature as (petiole) 8 (width 23): 31 : 16 : 19 : 53 : 19 : 8, all beyond 2 angled on median dorsal line and on hind margin when seen from above, tergite 5 microscopically punctate with a few hairs in middle on each side and more on anterior half of 6. Hypopygium very long, ventral spine hardly longer than broad, ventral valves not protruding. Using width of head as a base the length of mesonotum ratio is 1.06; antenna, 2.3; wing, about 2.2. Length, 3.6 millimeters.

*Male*.—Head red, rest of body dark reddish brown to nearly black. Antennæ 14-segmented, lengths as (scape) 16 : 6 : 10 : 17 : 16 : 16 : 15 : 15 : 14 : 14 : 13 : 13 : 12 : 19, all flagellar segments cylindrical, closely joined, tapering slightly toward tip. Hind metatarsus equal to 2-4 united. Abdomen slightly shorter than thorax, width and height about half length, lengths of tergites measured along dorsal curvature as (petiole) 11 (width 18): 26 : 13 : 17 : 14 : 12 : 18, a row of hairs near dorsal front margin of 5, on front half of 6 and covering 7. In side view tergite 4 is the largest. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 3; wing, 2.9. Length, 2.7 to 2.9 millimeters.

Described from 1 female and 3 males collected at Singapore (*Baker*).

*Type*.—Catalogue No. 24379, United States National Museum. Type female and allotype.

*Allo cynips borneensis* sp. nov. Plate 1, fig. 6.

*Female*.—Red to nearly black. Ocelli on prominent triangular elevation on frons bounded on sides by antennal grooves. Facial line 0.82 transfacial. Interocular space 0.57 transfacial and area 1.24 times as broad as high. Malar space 0.71 eye. Antennæ 13-segmented, lengths as (scape) 25 : 10 : 21 : 25 : 22 : 21 : 20 : 19 : 18 : 17 : 16 : 15 : 30. Truncation of pronotum margined, hind margin of pronotum forming a sharp rim which is higher than anterior part of adjacent mesoscutum but does not develop an erect median tooth. Mesoscutum broader than long,



parapsidal grooves complete, coarsely punctate in transverse rows. Scutellum not margined, disk punctate, two smooth pits at base. Hind tarsus longer than tibia, its metatarsus longer than 2-4 but shorter than 2-5, claws simple. Forewing dusky beyond basal, especially the radial cell which is 3.6 times as long as broad, first abscissa of radius slightly arcuate, one-third as long as second which meets the longer marginal at angle of  $20^{\circ}$ . Cubital reaching basal above middle. Abdomen longer than thorax, height 0.56 and width 0.34 length, lengths of tergites measured along dorsal curvature as (petiole) 10 (width 26) : 29 : 19 : 27 : 73 : 40, seventh not visible, all behind 2 angled along median dorsal line, tergites 5 and 6 microscopically punctate with larger setigerous punctures in middle on sides, ventral valves protruding horizontally. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 2.5; wing, 2.7. Length, 4 to 5 millimeters.

Described from specimens collected at Sandakan, Borneo (*Baker*).

*Type*.—Catalogue No. 24380, United States National Museum. Type female.

*Allocynips flaviceps* Kieffer.

This, the second species to be included in the genus, was described in 1916<sup>4</sup> from a female from Mindanao. This species is included in the above key from characters given in the literature, as the location of the type is unknown to me.

<sup>4</sup> Philip. Journ. Sci. § D 11 (1916) 286.



## ILLUSTRATIONS

### PLATE 1. ORIENTAL CYNIPIDÆ

- FIG. 1. *Oberthürella lenticularis* Saussure; side view of scutellum and abdomen, hind femur, and tarsus.
2. *Paribalia borneana* sp. nov.; abdomen of female and male, and hind tarsus.
3. *Mesocynips insignis* Cameron; abdomen of male and front tarsus.
4. *Liopteron tarsale* Ashmead; side view of abdomen.
5. *Allocynips isosceles* sp. nov.; abdomen and part of forewing.
6. *Allocynips borneensis* sp. nov.; abdomen, wing, and antenna.





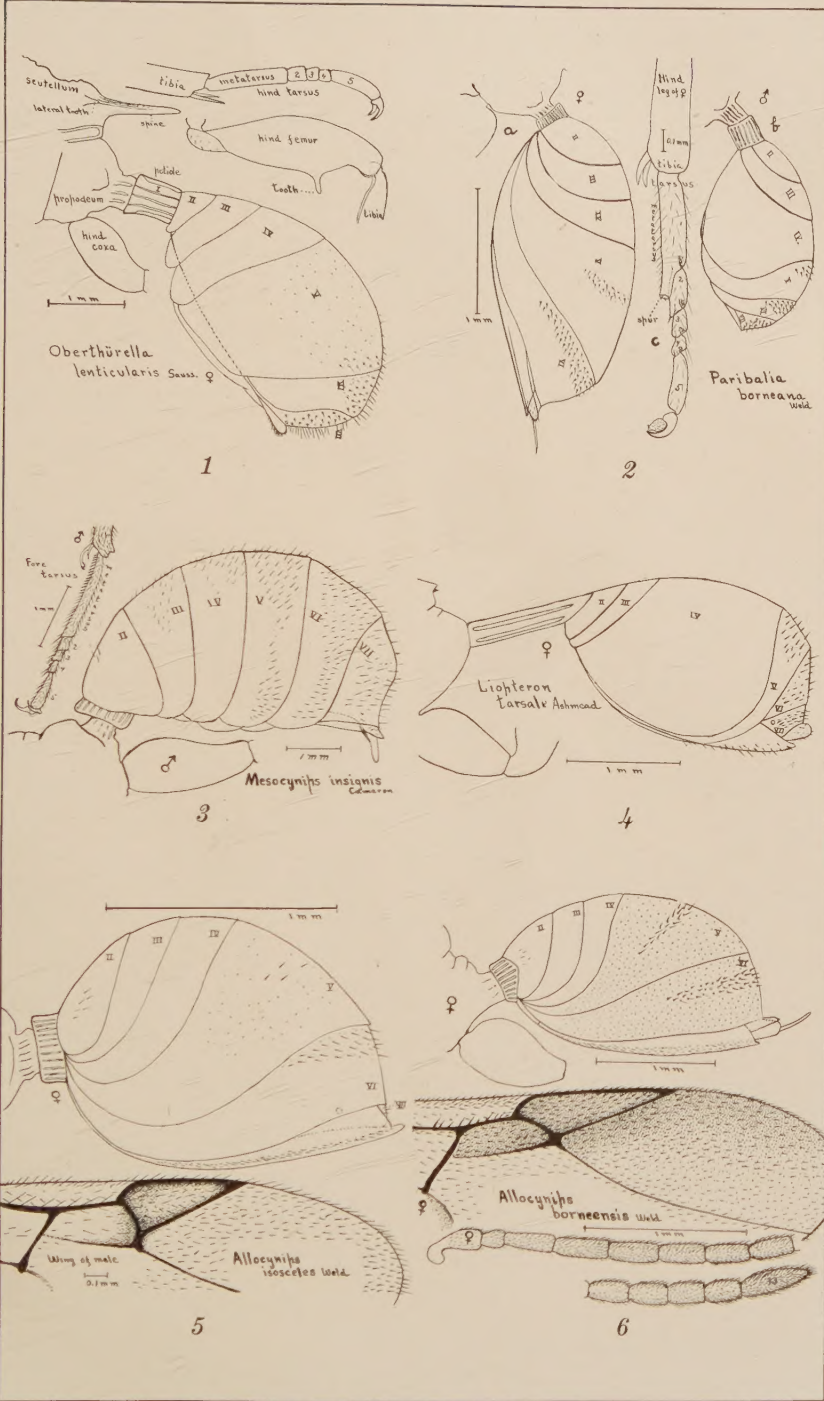


PLATE 1. ORIENTAL CYNIPIDÆ.

